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Analysis of Social Network Collaboration Using Selected APAN Communications from the Haiti Earthquake of 2010

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MONTEREY, CALIFORNIA

THESIS

**ANALYSIS OF SOCIAL NETWORK COLLABORATION
USING SELECTED APAN COMMUNICATIONS FROM
THE HAITI EARTHQUAKE OF 2010**

by

Michael F. Casper

June 2012

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**ANALYSIS OF SOCIAL NETWORK COLLABORATION USING SELECTED
APAN COMMUNICATIONS FROM THE HAITI EARTHQUAKE OF 2010**

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Submitted in partial fulfillment of the
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ABSTRACT

On January 12, 2010, a 7.0 magnitude earthquake occurred 16 miles west of the Haitian capital of Port-au-Prince. The earthquake and ensuing destruction killed as many as 300,000 persons and displaced as many as 1.5 million more creating a humanitarian crisis and economic disaster of enormous scale. As the earthquake was in close proximity to the U.S. mainland, it was determined that three U.S. agencies would take leading roles: USAID would coordinate and lead the relief effort, the U.S. State Department would handle diplomatic issues and the Department of Defense (DoD) would take the lead on logistics and security issues. One social networking tool used by the DoD and relief organizations to share information and coordinate relief efforts was the All Partners Access Network (APAN). Communications between the various agencies were recorded and include chat logs, blogs and e-mails. A content analysis was conducted to develop insight into the way relief workers used APAN when responding during the Haiti humanitarian assistance / disaster relief (HA/DR) operation. Coding and analyzing the communication data collected during the relief effort provided insight into how individuals and organizations used APAN, a social networking tool, to collaborate during the disaster. Suggestions for improving APAN are discussed.

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LIST OF ACRONYMS AND ABBREVIATIONS

AOR	Area of Operations
APAN	All Partners Access Network
BCT	Brigade Combat Team
COP	Community of Practice
CSCW	Computer Supported Cooperative Work
DART	Disaster Assistance Response Team
DISE	Distributed Information Systems Experimentation
DoD	Department of Defense
ERS	Emergency Response System
ERU	Emergency Response Unit
GIN	Global Information Network
HA/DR	Humanitarian Assistance/Disaster Relief
IHD	International Health Division
IHRC	Interim Haiti Recovery Commission
ISP	Internet Service Provider
JTF	Joint Task Force
MEU	Marine Expeditionary Unit
MINUSTAH	United Nations Stabilization Mission in Haiti
MSSQL	Microsoft Structured Query Language
NGO	Non-Governmental Organization
OCHA	Office for the Coordination of Humanitarian Affairs
ONR	Office of Naval Research

PACOM	Pacific Command
RFI	Request for Information
SOUTHCOM	U.S. Southern Command
SSTR	Stability Security Transition and Reconstruction
TISC	Transnational Information Sharing Cooperation
UCG	User Generated Content
UN	United Nations
USA	U.S. Army
USAF	U.S. Air Force
USGS	U.S. Geological Survey
USMC	U.S. Marine Corps
USN	U.S. Navy
WWW	World Wide Web

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I. INTRODUCTION

A. ORGANIZATION

This thesis is comprised of five chapters. Chapter I provides a synopsis of the Haiti earthquake and background on the challenges faced by organizations providing humanitarian assistance / disaster relief (HA/DR). The All Partners Access Network (APAN) Web site, one of several tools used by responders to collaborate, is also introduced. Lastly, the goals of the study are presented. Chapter II reviews relevant literature and defines applicable concepts related to social media, knowledge management, and HA/DR. Chapter III describes the methodology used to conduct the study and introduces definitions used for coding the data that was analyzed for this research. Chapter IV presents the results that include both quantitative and qualitative analysis of the data. Specific threads from the APAN data are discussed in depth and network diagrams are provided to aid in visualizing the data flow during the collaboration that transpired. Finally, Chapter V draws conclusions about the results and proposes system interface improvements for the APAN Web site before recommending areas for future research.

B. BACKGROUND

On January 12, 2010, at 1653 local time, a catastrophic earthquake struck Haiti. The quake measured 7.0 on the Richter scale and was centered 16 miles west-southwest of the capital Port-au-Prince. By January 20, Haiti had experienced 59 aftershocks of magnitude 4.5 or greater and sixteen of those aftershocks had magnitudes of 5.0 or greater (USGS, 2010). Also, due to the relative shallowness of the quake's epicenter and the rock formations the island nation is situated on, Haiti experienced amplification of the shaking phenomena common to earthquakes (USGS Release, 2010). The devastation was enormous resulting in an estimated 300,000 killed, another 300,000 injured and as many as 1.5 million people displaced. "The U.N. and other aid agencies have characterized the January 12, 2010, earthquake in Haiti as the largest urban disaster in modern history" (USAID, 2012).

The damage was exacerbated by the poor construction of many of Haiti's buildings. An estimated 400,000 buildings were damaged or destroyed, including 28 of 29 government ministry buildings, and the National Palace and Parliament (USAID, 2012). As much as 30 percent of Haiti's civil servants died in the quake. The Haitian government could not cope with disaster on such a massive scale.

Following the destruction caused by the initial quake, the president of Haiti, Rene Preval, declared a national state of emergency and, in doing so, requested that the United States help provide humanitarian assistance and disaster relief. The U.S. ambassador to Haiti responded by issuing a disaster declaration, confirming that the situation warranted U.S. aid (Fraser & Hertzelle, 2010). By February 2, 2010, 102 countries had responded with offers of personnel, aid or financial support (Margesson & Taft-Morales, 2010) and the UN Office for Coordination of Humanitarian Affairs estimated there were at least 400 non-governmental aid agencies operating in Haiti (USAID Factsheet #26).

The lead U.S. agency during the disaster was USAID however, the Department of Defense (DoD) played a significant role, especially in the first hours and days after the quake occurred. The DoD response was led by U.S. Southern Command (SOUTHCOM) which stood up a subordinate command, Joint Task Force Haiti (JTF Haiti), within hours of the earthquake. JTF Haiti was created on January 13 and had initiated the U.S. military's efforts named Operation Unified Response. At its peak, Unified Response entailed as many as 20,000 personnel and 19 ships (AFP, 2010).

Though the outpouring of aid to Haiti was great, initially conditions in Haiti hampered relief efforts. The Toussaint L'Ouverture airport tower, lighting and terminal were damaged as were the seaport's loading and unloading wharfs and cranes (Pasztouret al., 2010). Much of Haiti's communications and power infrastructure was destroyed as well. Immediate steps needed to be taken to facilitate the arrival of incoming aid. By January 13, the USAF had assumed control of the airport enabling the first aircraft carrying personnel and aid to land. The seaport had reopened on January 22 and was capable of offloading up to 250 containers a day (Kraft & Ellingwood, 2010). To coordinate the various relief efforts taking place, SOUTHCOM leveraged social media, in particular, the All Partners Access Network.

C. ALL PARTNERS ACCESS NETWORK

The All Partners Access Network (APAN) is an Internet based collaboration tool that was used extensively to facilitate communications between the DoD and other governmental and non-governmental organizations (NGO) providing relief to Haiti. APAN helped USSOUTHCOM respond to requests for assistance, maintain situational awareness through user updates, and share DoD imagery with the international community (Fraser & Hertzelle, 2010). APAN, initially developed by U.S. Pacific Command (PACOM), is a social media Web site where members can utilize various functions including chat, forums, blogs and wikis to share information. Forums are particularly important as they provide the medium that enables people to ask questions of the disaster relief community and make requests for material and information as well as offer help or point out resources that others can draw on (Ives, 2010). APAN is described as “a ‘community of communities’ web site that combines the benefits of unstructured collaboration (wikis, blogs, and forums) and structured collaboration (file sharing, calendar) with the personalization of social networking” (APAN Web site, 2012).

APAN users include members, managers, and owners participating in one or more groups maintained on the APAN Web site. The Haiti HA/DR site is an example of one such group or community among the various communities residing on the APAN Web site.

APAN is designed to be simple to use and requires only an Internet connection to log on. In the summer of 2010, a demonstration of the latest iteration of APAN, the Transnational Information Sharing Cooperation (TISC), was planned to take place at SOUTHCOM as a means of facilitating coordination between DoD entities and “any external country, organization, agency or individual that does not have access to traditional DoD systems and networks.” (APAN Web site, 2012) Prior to initiation of the exercise, the earthquake struck Haiti. By the time major U.S. military operations in Haiti had ended in June of 2010, over 1700 distinct users (Pierce, 2010) representing 107 organizations had utilized the Web site.

As a collaboration tool, APAN allowed various users and organizations to share information with the community about their capabilities and available resources. It also allowed the use of formal and informal networks to accomplish tasks that otherwise would have been more difficult to accomplish. An example of how APAN was used to collaborate can be seen in the interaction between several organizations on thread 7023 titled, “Transportation of Medications.” The original post describes an NGO named World Cares and the user mentions how they often receive small donations of medications or food that are not large enough to benefit from bulk shipping. Two responses provide information concerning donating materials to USAID and the contact numbers necessary to do so. A third response provides the information necessary to contact the Red Cross to provide donations of medical supplies. Peer-to-peer collaboration allowed critical and diverse information from several geographically distributed participants to flow across organizational boundaries. Information shared via APAN flowed more quickly than would occur by utilizing point-to-point communications such as telephone or e-mail.

D. GOALS OF THE STUDY

By June 3, 2010, over 1395 forum posts had been logged on the APAN HA/DR forum. For this research, the individual posts were segmented into thought units and coded with the purpose of developing data which could then be used to identify the properties of the communication taking place within the topic threads. The goal of this research was to analyze communications that transpired between HA/DR responders using a social media collaboration site to gain insight into how various responders collaborated during an HA/DR event. Another goal for this study was to understand how social networks are used to facilitate knowledge sharing. Finally, this research attempted to provide insight into how individual users collaborated via social media during disaster response efforts using APAN and to leverage this understanding to suggest improvements to the APAN Web site.

II. LITERATURE REVIEW

A. KEY CONCEPTS

Before an investigation into the use of a social media platform can take place, several concepts concerning the interaction of the participants and the technology utilized for interaction must be considered.

1. Data, Information, and Knowledge

Data, information, and knowledge are a group of overlapping concepts related to how humans perceive and think about the world around them. Data refers to a collection of isolated facts, measurements, or observations. By recognizing or defining patterns in data, it can become information: Information is data that has been given meaning. Recognizing the relationship between pieces of information can lead to knowledge. The key difference between knowledge and data or information, is that new knowledge can be created with existing knowledge.

Together, data, information, and knowledge can be thought of as forming a hierarchy with the largest category, data at the bottom, information in the middle and knowledge at the top. The difference between the three categories is usually described in terms of the level of abstraction applied. The more abstract the concept, the lower down the hierarchy it is. Understanding is a cognitive and analytical process which enables new knowledge to be synthesized from previously held knowledge. An understanding of the properties and qualities of each level facilitates moving up the hierarchy (Bellinger, Castro & Mills, 2004). Connectedness describes the relationship between things or events.

To better understand the relationship between data, information, and knowledge the following example is provided: A group of ten numbers is considered data. If those numbers were connected and organized into two groups of three and a group of four, they may represent a phone number from North America. The numbers have some meaning imparted to them so they are considered information. If someone knows that those

numbers can be used to contact a specific person or organization, the information contained by the numbers becomes knowledge. The relationship between data, information, and knowledge is shown in Figure 1.

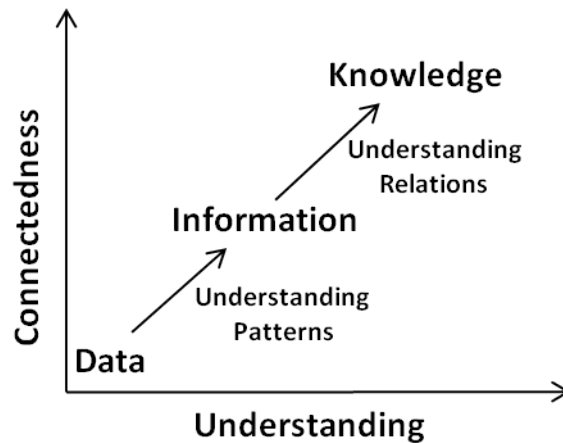


Figure 1. Diagram Depicting the Transition from Data to Information to Knowledge (After Bellinger, Castro, & Mills, 2004)

When discussing the concepts of knowledge transfer or information gathering within the context of a social media, it is not necessary to fully examine the epistemological requirements for a definition of knowledge. Rather, a more specific, working definition, based on the related works of both Nonaka (1994) and Huber (1991) will suffice. Knowledge for the purposes of this research will be defined as “a justified belief that increases an entities capacity for taking effective action” (as cited in Alavi & Leidner, 1999, p. 13)

2. Knowledge Management

In the organizational management literature, “Knowledge management is a process of identifying, capturing and leveraging the collective knowledge in an organization to help the organization compete” (Van Krogh, 1998) or to collaborate with other organizations to accomplish a set of specific goals.

A knowledge management system can be comprised of one or more of the following sub-systems: (1) A document management system can provide the means to create, store, track, and retrieve electronic documents and or images relevant to the organization. (2) Collaboration tools refer to systems used by people who are working on a common task. These collaboration tools facilitate users in achieving their goals by providing the capability to communicate via e-mail, share calendars, use real-time chat, share information via wikis and blogs and coordinate workflow. (3) Wikis are a type of Web site that provides a means for participants to add, remove, and edit available content. They also serve as a means of information storage and dissemination. Wikis generally contain organizational knowledge as they can be edited by anyone with access and therefore the information contained is agreed upon or accepted by the whole. (4) Blogs on the other hand, are personal Web sites that give participants the opportunity to create and share ideas in an informal environment; however, the information contained can only be edited by the originator of the blog. Some blogs provide a means for visitors to leave comments in an interactive forum.

3. Internet Interactivity and Social Media

The Internet and the World Wide Web (WWW) make possible the interconnection of millions of individuals, organizations, governments, and societies. By connecting millions of users, the “Internet has the capacity and the resources to send a tremendous amount of information to large numbers of receivers simultaneously” (Paul, 2001, p. 740). The Internet, however, is more than simply a portal to static content similar to traditional mass media. Rather, the Internet facilitates interaction between the consumers of information and the creators of the information as well as allowing the information to be discussed by many other receivers, offering the opportunity for users to be both receiver and sender concurrently (Paul, 2001).

The beginning of the 21st Century saw the continued evolution of the Internet and the WWW with the introduction of social media and the concept of Web 2.0. The term Web 2.0, coined in 1999, was used to describe a new way in which developers and end-users utilized the WWW. Content began to shift from being created, pushed, and

maintained solely by individuals or organizations, to content that could be modified or updated by multiple users in a highly collaborative environment (Kaplan & Haenlein, 2010). In other words, the web began to evolve from a static source of information to a participatory platform as user-generated content became more commonplace. User generated content (UGC) is created by regular people, or users, who voluntarily contribute data, information, or media that can then be accessed by, or appears before, others in a useful way, usually on the Web (Krumm, Davies, & Narayanaswami, 2008). Social media combines the two concepts of Web 2.0 and UGC, such that “social media is a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content” (Kaplan & Haenlein, 2010, p. 61).

Rapid expansion of the use of social media spread to many facets of life and included use by the U.S. Federal government, international aid organizations, and NGOs during HA/DR operations. Social media has become a great facilitator of information sharing however, in some applications, especially HA/DR situations, government and NGO coordination requires information that is both accurate and timely. When multiple agencies respond to a disaster, they need to coordinate their information sharing efforts; however, such sharing can lead to multiple reports with conflicting information (Yates & Paquette, 2010). This is especially prevalent among public social media sites as Qu et al., (2011, p. 2) note, “On the one side rumors may spread quickly in social media, causing panic in the community. On the other side, people may doubt authentic reports if the sources of the reports are not specified or if they do not trust the information sources.” APAN addresses these problems by requiring users to be accepted into the community, a process known as vetting. Accepting a new member into the community does not guarantee the vetting process has taken place. Consequently, the information new members share may not be trustworthy, however, the goal is to improve the quality of information exchanged. In this sense, APAN becomes a “walled garden” where “information is at once more trustworthy and less accessible to those outside of the network” (Goggins, Mascaro, & Mascaro, 2012, p. 1).

4. Information Push and Pull

The notion of information “push” versus information “pull” is one of the key concepts of a social media platform. Pushed information involves any information dissemination strategy that pushes its way in front of users without the user initiating the request. Examples of information push include advertising, posting information to blogs or wikis, and news releases. In contrast, information pull involves connecting a user who is actively looking for specific content to a source of information. In the case of information pull, the end user has initiated the request and the maintainer of the information, or the information provider, fulfills the request. Examples of information pull can include asking a question or placing an order. The flow of any information is a process while information is always either pushed or pulled.

A brief examination of pre-Internet mass media will lay the groundwork for a greater understanding of the difference between information push and pull. Traditional mass media such as newspapers, radio, or television broadcasts are generally regarded as a means to push information to a participant or consumer. The consumer of the information does not know what information will be sent. To continue the newspaper metaphor, once the newspaper is in hand, the consumer may scan the headlines and read some articles while ignoring others. Once the articles are available to the information consumer, the consumer may pull the articles he/she is interested in. This is an example of how pushed information transfers to the pull domain. Similarly, if the consumer subscribes to a daily newspaper service, the consumer is described as having information pushed to him/her; if, however, the consumer travels to a newspaper box and purchases a paper, this is described as a pull situation.

To continue the metaphor, the newspaper reader from the above example sees an ad for a set of encyclopedias while reading the paper. The ad was pushed to the reader as he/she did not initiate or expect the information. At the same time, the ad creators pushed information to a large group of consumers with the expectation that some number of consumers would reply. The replies are expected and considered pulls from the perspective of the ad creators. The newspaper reader calls the sales representative and orders the set of encyclopedias. Though the consumer responded to a pull in the form of

the original ad, he/she is now pulling the information he/she wants that is contained in the encyclopedias. The entire body of information contained by the encyclopedias is pushed to the consumer; once the information consumer looks for a particular subject within the books, the consumer is pulling information.

The above notions of push and pull can be applied to social media. A participant on a social media Web site can push information to the community by posting an article, thought, or a particular image to a forum, wiki, or blog. This information is unexpected by the other participants. Once it is available, however, it can be pulled by the other users of the media; they can scan the titles of blogs or forum threads to determine if the information within the post appears valuable to them. Similarly, a participant can pull information from the community by posting a query or a request for information (RFI). Once the query has been made available to the community, parties that have the answer or information available can respond by posting the information for, not only the original requester, but for all members of the community to see. Understanding the differences between push and pull methods of information sharing makes it possible for the creators of a social media Web site to improve the user interface and processes included on the site, enabling greater information sharing.

B. INTER-ORGANIZATIONAL COLLABORATION

Due to the complexity involved with large-scale disasters, no single entity can be expected to have the resources and organization to deal effectively with all aspects of a disaster. Large-scale disasters require a large-scale response and when the disaster occurs in a developing country, a response from the international community is required to mitigate the loss of life and property. Also, in an increasingly globalized economy, a disaster in one area may have economic impacts in many others. Once a disaster occurs, many organizations and agencies will be required to respond with various types of expertise, including: search and rescue, logistics, electrical power systems, water supply systems, transportation, and health care, to name a few (Ghoerghe & Mili, 2004).

Organizations participating in HA/DR will need to both collaborate to share information and coordinate their efforts, if they want to achieve favorable outcomes in both the short- and long-term phases of disaster response.

Collaboration, according to Gray (1985, p. 912) refers to the “pooling of appreciations and/or tangible resources, such as information, money, labor, etc., by two or more stakeholders to solve a set of problems which neither can solve individually.” Bedwell et al. (2012, p. 3) have narrowed the definition to: “collaboration [is] an evolving process whereby two or more social entities actively and reciprocally engage in joint activities aimed at achieving at least one shared goal.” In the case of HA/DR a shared goal may occur during the initial response to the disaster such as locating survivors and administering first aid or may be more complex and involve rebuilding destroyed critical infrastructure. Due to the very nature of the complex environment following a disaster, the enablers of collaboration, that is, coordination and cooperation, are not sufficient to fully manage all aspects of the disaster. Collaboration, in addition to involving coordinating effort and sequencing events, also requires sharing and brokering information to achieve novel solutions, and as such, is more applicable to the HA/DR environment.

Researchers differentiate between collaboration, cooperation, coordination, and teamwork. As illustrated in Figure 2 (after Bedwell et al.), coordination, to varying degrees, can be an element of collaboration when participants are performing tasks as part of a collaborative environment; however, not all coordinated activity entails collaboration (e.g. sequencing of tasks). Similarly, cooperation facilitates collaboration but may apply to efforts that cannot be defined as collaboration (such as entities engaging in a single activity vice an evolving process with multiple activities). Finally, Bedwell et al. argue that teamwork is an instantiation of collaboration, and thus, all teamwork is collaboration (2012). This author, however, can think of several examples of teamwork that do not fulfill the definition of collaboration. Some tasks a team may work on are so well defined or have been conducted so often, that though the team may require coordination and/or cooperation to achieve the desired end state, the team’s interaction may not rise to the level of collaboration. Examples of teams that may not need to

collaborate include a team of air traffic controllers, a surgical team, or an emergency response team. In these examples, novel solutions are not desired, rather, efficient completion of the goal is paramount. In cases where a novel solution to a problem is required, or the problem set is so complex one organization could not be expected to achieve the desired results, a collaborative effort may prove useful. A collaborative effort may also have other goals as an end state, i.e. a diversified response capability, stakeholder interests considered in the solution, improved stakeholder relations, etc. (further benefits of collaboration are discussed later in this chapter).

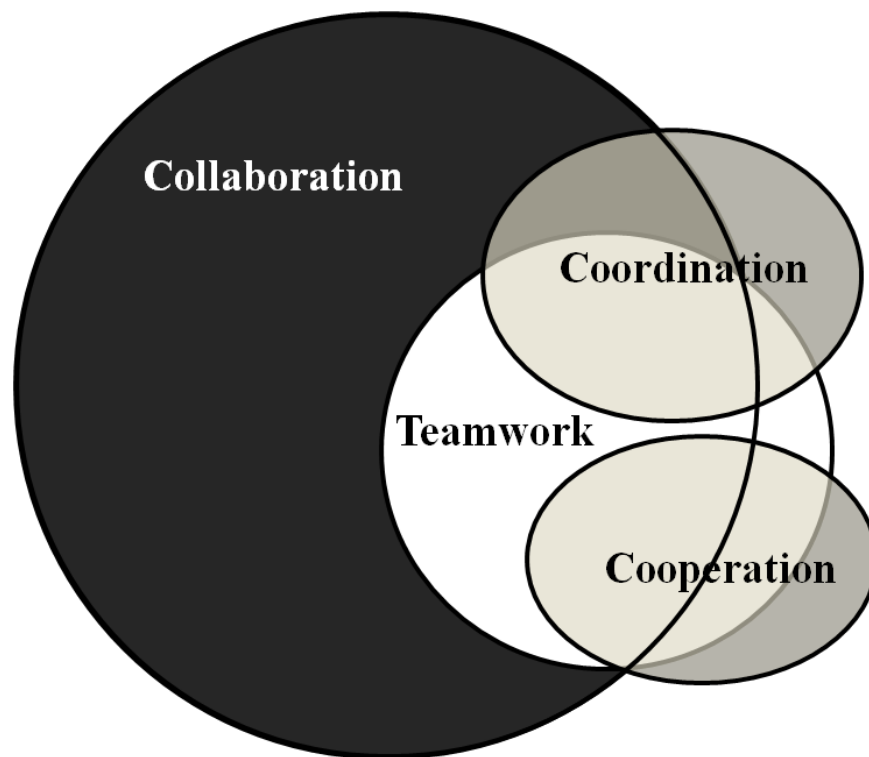


Figure 2. Shared Criterion Space Between Collaboration and Related Constructs
(After Bedwell et al., 2012)

Through collaboration, HA/DR participants can inform other key players about the allocation of scarce resources, query others for information, coordinate their efforts and share best practices; they can form collaborative partnerships. According to Roussos & Fawcett (2000, p. 369), “a collaborative partnership is an alliance among people and organizations from multiple sectors... working together to achieve a common purpose.”

APAN exemplifies this concept by bringing together experts and participants from multiple HA/DR communities to share and collaborate in an effort to set priorities and achieve immediate goals.

1. Building A Collaborative Community

Most readers will be familiar with the concept of a community; however, there are many definitions. For the purpose of this research, a community is any group of people that have a shared body of interests due to location, history, culture, or profession. The commonality of concerns is sometimes referred to as a domain of interest. Erickson (1997) lists several factors that make a community. Membership refers to the idea that they are not all inclusive. Prospective individuals may need to meet specific criteria for inclusion. Communities foster the development of personal relationships and lead to mutual commitment to the same goals and ideals. One member may help another simply due to their membership in the community vice their personal relationship. Members share a common set of concerns, values, goals, practices, procedures and symbols. Members participate in the creation, control, and distribution of various collective goods (including information). The aforementioned characteristics take on importance only because the community as a collectivity is expected to have a long existence.

To interact effectively within a community, an organization must have some interest in the domain of concern. In the case of a single disaster, the domain may be limited to the geographical area and immediate effects of the disaster. To a community of practice such as first responders or emergency response personnel, however, the domain may exist for a much longer period of time and include lessons learned from previous actions, knowing where to find subject matter experts, and the ability to work with others in the community to accomplish tasks. These longer lasting aspects of the community also represent some of the benefits of social media in that, knowledge, once gained, can be stored and retrieved over time by future members of the community.

a. Stakeholders

Gray (1989) identifies five key factors that must be present in order to build a collaborative community. First, the stakeholders must have an interest in the problem. Stakeholders are defined as those with a stake in the problem. In an HA/DR response, especially one involving a developing country, one may rightly ask who the stakeholders are. In 2011, Emory Law University held a symposium entitled, “A Worldwide Response: An Examination of International Law Frameworks in the Aftermath of Natural Disasters.” Nearly all of the Symposium’s contributors believed the international community *must* respond to a disaster (Hernandez & Johnson, 2011). This makes any responder a stakeholder by definition.

The second requirement is interdependence. As noted previously, the sheer scale of a disaster and the myriad problems arising would overwhelm any single entity. Responding agencies become dependent on each other and they must work together to implement solutions to all of the issues at hand.

b. Solutions

A third key element of collaboration is the idea that solutions emerge by dealing constructively with differences (Gray, 1989). With multiple organizations responding to a disaster, some will have more expertise in specific areas than others, yet, those with less expertise may have novel ideas for solving a problem. Harnessing this potential to solve problems is at the heart of collaboration. While exploring the possibilities of a novel solution can be worthwhile, the immediacy of disaster response does not always allow for such practices to take place. This provides a strong case for after action reports, lessons learned, and continued collaboration as a means to develop best practices.

c. Decisions and Responsibility

The next two elements are inter-related and involve joint ownership of decisions as well as assuming collective responsibility for the future direction of the domain. This means that participants are directly responsible for reaching agreement

regarding solutions as well as restructuring the socially accepted rules of interaction to accomplish goals. Collaboration often leads to increased coordination among stakeholders although that is not a necessary outcome of the process (Gray, 1989). In the domain of disaster response, creating long lasting ties between responding agencies and organizations is an intangible benefit to the collaborative process.

d. Collaboration as Process

Gray (1989, p. 15) describes collaboration as “an emergent process rather than a prescribed state of an organization.” By describing collaboration as a process it is possible to understand how various organizations may enter into collaborative partnerships, which can grow to become a collaborative community and continue evolving over time. As organizations continue to interact within the collaborative community, solutions to problems may emerge that no single participant could have envisioned or enacted on their own.

2. Virtual Community

Combining the above criteria that are used to define a collaborative community with a virtual dimension, describes the creation of a virtual community, or one that is geographically dispersed and uses technology to interact. Redfern & Naughten (2002, p. 204) refer to the “space” where interaction occurs as a “collaborative virtual environment; a computer-enabled, distributed virtual space or place in which people can meet and interact with others, with agents and with virtual objects.” APAN is one such *place* where individuals and organizations involved in HA/DR can *meet* to share ideas, request information, and collaborate on specific problems or disasters.

a. Awareness

In order for members of a virtual community such as APAN to work together efficiently and effectively, they must be aware of situations or problems for which they may be able to contribute solutions. Awareness is the condition of “having knowledge or cognizance of something” (Mirriam-Webster). In the computer supported cooperative work (CSCW) research literature, awareness is defined as “any information

that is highly relevant to a specific role and situation of a process participant” (Baker et al., 2002, p. 145). Refining this definition further and applying it to the HA/DR participant, results in information relevant to a specific person or organization responding to a disaster, at a specific time and place.

The APAN community Web site is a knowledge management platform that affords responders from disparate organizations the ability to pool their collective knowledge and to bring this knowledge to bear at the appropriate time. This is accomplished through several mechanisms including pushing or pulling information and connecting users with information. The most basic of these is the push of knowledge to the group to make the community as a whole *aware* of a specific piece of information. Pulling information may involve a two-way interaction or be an individual act where information is obtained from the community either by reading what has previously been generated or by requesting information from the community. Connecting users entails responding to a query, not necessarily with a direct answer, but with knowledge of who maintains the specific information requested or where the information resides and how to access it. Previous literature also refers to this concept as the mediation and coordination of activities (Goggins et al., 2010).

b. Types of Users

Pushing knowledge in a virtual community is accomplished via a type of user known as a knowledge steward. This type of user is one who has some specific piece of information and the desire to share it with others. They provide the most value to a community of practice (COP) by creating, organizing, or distributing knowledge (Brazelton & Gorry, 2003). While in a typical organization knowledge stewards represent the smallest group, as depicted in Figure 3, an HA/DR community is built around the principle of knowledge sharing; knowledge stewards may therefore represent a larger portion of an HA/DR group.

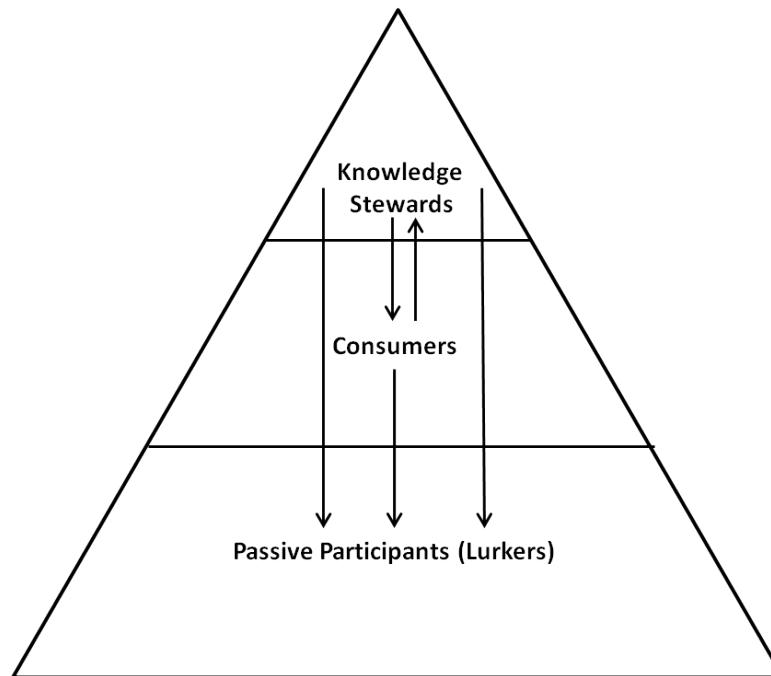


Figure 3. Types of Knowledge Sharing Participants (From Cook & Cook, 2004)

As knowledge stewards are often the most active members of a virtual community by relative percentage of posts, they may also serve as connectors or information brokers. A connector, is someone who knows lots of people, but more importantly, one who “occupies many worlds, subcultures and niches” (Gladwell, 2000, p. 48) allowing them to connect one member of a community with others. An information broker technically “is a professional who is skilled in a number of areas, that combined, provide [someone] with the best chance of obtaining the information [they] need” (Londrie, n.d.). More generally Gladwell (2000), defines an information broker as someone who accumulates knowledge. In a virtual community of communities, like APAN, the combination of these two concepts would be someone who collects knowledge of where specific information resides or how to access it. The information can then be shared among all of the communities of APAN.

Consumers are the second largest group of users in a community. They apply the knowledge gained from the community and typically add their own experiences and insights which potentially generates additional knowledge. A consumer may also query the community in an effort to gain specific knowledge. A response to a query,

typically from a knowledge steward, adds to the overall knowledge of the community as a whole... as the old adage says, “If you have a question, it is likely that someone else has the same question.”

Finally, Brazelton and Gorry (2003) describe the third type of user, the passive users who remain unseen and unheard.

The third and largest group... [is the] passive participants, [those] who do not contribute and may not adopt knowledge and practice from the community. From system logs, we know they are often connected, but they leave no other trace. For this reason, we refer to them as “lurkers.” Their continued connection to the community, however, suggests it has value to them. (p. 25)

As with many virtual communities, APAN has more registered users than users who have posted at least one time. (Goggins et al., 2010). This implies that they are gaining some benefit from being members of the community even if they do not share information. Perhaps, merely being aware of information is sufficient for those users.

3. Benefits Of Collaboration

When agencies collaborate in an HA/DR event, they do so with the expectation that there will be benefit derived from the collaboration, not necessarily for themselves, but for the population affected by the disaster. Table 1 lists the benefits of collaboration gleaned from the research literature. Some of the benefits described may not apply to HA/DR situations, however, many of them will be realized by organizations and individuals, both those participating in the DR effort and those receiving the relief efforts.

Table 1. Benefits of Collaboration (After Gray, 1989, Hansen and Nohria, 2004, and Sturtevant, Moote, Jakes & Cheng, 2005)

1.	Broad comprehensive analysis of the problem domain improves the quality of solutions
2.	Better decision making as a result of advice obtained from experts in the field
3.	Response capability is more diversified
4.	Enhanced capacity for collective action that involves dispersed participants
5.	It is useful for reopening deadlocked negotiations
6.	The risk of impasse is minimized
7.	The process ensures that each stakeholder's interests are considered in any Agreement
8.	Parties retain ownership of the solution
9.	Parties most familiar with the problem, not their agents, invent the solutions
10.	Participation enhances acceptance of solution and willingness to implement it
11.	The potential to discover novel, innovative solutions is enhanced through the cross pollination of ideas
12.	Relations between the stakeholders improves; builds capacity, networks, and relationships
13.	Costs associated with other methods are avoided
14.	Mechanisms for coordinating future actions among stakeholders can be established

In an HA/DR event, responders from many organizations collaborate to make efficient use of the limited knowledge, resources, and expertise available to any one of them. As such, it may be useful to understand why particular organizations collaborated and the benefits of collaboration they realized. “In general, collaboration helps people [and organizations] achieve goals together that they could not achieve independently” (Sturtevant et al., 2005, p. 4) and “collaboration can lead to better decisions that are more likely to be implemented and, at the same time, better prepare agencies and communities for future challenges” (Wondolleck & Yaffe, 2000, p. 23). While there are many

potential benefits to be gained by agencies collaborating, many of them do not lend themselves to coding as they are invisible or intangible. In fact, most of the benefits listed in Table 1 cannot be discerned from coding the communication that transpired in APAN during the Haiti HA/DR operation.

When a disaster occurs, multiple governmental, international, and non-governmental organizations respond to the disaster and need to coordinate their efforts to make effective and efficient use of the limited resources available to them. Effectively increasing their efficiency may take several forms. Reducing duplicative effort, effective management of the movement of vital supplies or personnel to areas most in need, and combining resources for mutual benefit are some realizations of increased efficiency during an HA/DR event.

In a disaster situation, events on the ground may not be known outside of the local area due to damaged infrastructure or casualties among those responsible for disseminating information. Also, the situation may be rapidly changing due to many factors including the consumption of limited supplies, movements of displaced persons, degradation of normal civil authorities, or damaged transportation infrastructure, to name just a few. Information sharing across traditional functional boundaries is of vital importance. The ability to update and relay information quickly and effectively concerning the situation on the ground is a key benefit of collaboration.

Enabling effective coordination is another benefit of collaboration. As personnel and aid begins to flow into a disaster area, organizations may not know who is already operating in the area or who is planning to enter a specific area.

Building trust among various users is an important benefit of social media sites such as APAN. “[DoD International Health Division] IHD member Cdr. Patrick Laraby, MC [Medical Corps], USN, said NGOs prefer to maintain neutrality from the government, so there is an inherent friction between them and DoD.” Further, he adds, “NGOs do not want to be coordinated by the military, so it is best to collaborate and

coordinate with them from the beginning” (Pueschel, 2010). Maintaining continuous collaboration with partners via APAN enables members to build trust in each other and prepare for future disasters.

4. Obstacles to Collaboration

Though there are many potential benefits to collaboration, there are also inhibitors to the collaborative process. Individuals and organizations attempting to collaborate via social media may have to overcome one or more obstacles to achieve successful results. Table 2 lists some of the limitations and obstacles to successful collaboration found in collaboration literature.

Table 2. Obstacles to Collaboration (After Gray, 1989, London, 1995, and Hansen & Nohria, 2004)

1.	Collaboration is time-consuming and is not suitable for quick decisive action
2.	Power inequalities among participants can derail the process
3.	Decision making and achieving consensus sometimes require that the common good take precedence over the interests of a few
4.	Collaboration works best in small groups
5.	Collaboration is meaningless without the power to implement the final decisions
6.	Institutional disincentives may be in place to dissuade certain groups from collaborating
7.	Historical and ideological barriers may cause organizations involved to not trust each other
8.	Societal-level dynamics may cause groups with differing cultural backgrounds to avoid collaboration
9.	Participants may be unwilling to seek help
10.	Participants may experience an inability to seek and find expertise
11.	Participants may be unwilling to help others
12.	Participants may experience an inability to work together to transfer knowledge effectively

Collaboration is not a cure-all for every problem and there are times when collaboration, if not properly managed, can present problems of its own. Potential challenges to collaboration include: (1) Being involved in meetings, both virtual and face-to-face, that may be unproductive or where nothing of substance is accomplished (Hansen & Nohria, 2004). (2) When using social media, the desire of participants to continuously check for information updates or responses to posts may prove distracting. (3) Information can become lost or under-utilized if there are no means to cross-reference or identify large volumes of information being shared (Yates and Paquette, 2010). (4) Information overload is a potential problem in that participants may have to sift through multitudes of shared information and spend time finding the piece of information that pertains specifically to them. (5) Finally, enabling participants the power to add information to forums, wikis, and blogs introduces the potential for uncorroborated information. In a disaster response situation, the information shared must be constantly checked for accuracy (Yates & Paquette, 2010).

C. DISASTER RESPONSE

In response to several disasters in the 1980s, a field of study evolved around the idea of crisis management in business organizations (Shrivastava, Mitroff, Miller & Miglani, 1988). Over time the study of crisis management has been applied to disaster response by government and non-government agencies. Any organization responding to a disaster will face knowledge management challenges due to degraded infrastructure, including inoperative or destroyed communication and information systems, blocked or damaged transportation networks, and limited logistics capability due to degraded communications systems. Information flow may be lacking or non-existent. Goggins et al. (2010) state that information flows in several ways, including (1) information disseminated by authorities to the community at large, (2) information that flows from the community to authorities, and (3) information that is shared peer-to-peer. To counter the challenges of a disaster and take advantage of the flow of information, responders must have access to support networks that maintain the ability to share and coordinate information between agencies, especially peer-to-peer communications. Research has been conducted to understand the challenges and issues facing the implementation of ad

hoc networks allowing responders access to various means of communication including the Internet. The ways ad hoc networks are implemented are outside the scope of this thesis; however, the topic remains an important area of study. Once connectivity to the Internet has been established, collaboration between responding agencies and their support networks can occur more readily using social media Web sites.

1. Attributes of a Successful HA/DR Forum

To facilitate the collaboration required to effectively respond during a disaster, a successful Web site must be highly interactive. Paul (2001) identifies several attributes that can be used to measure the interactivity of a Web site which include: (1) ease of adding information, (2) facilitation of interpersonal communication, (3) responsiveness to users, and (4) immediacy of information among others. Increasing the interactivity of a Web site enables the participants to increase the site's value which is "predicated on frequent contributions of small knowledge chunks in various forms that are easy to acquire, share, and use" (Yates and Paquette, 2010, p. 2). Sharing knowledge among users results in the creation of knowledge networks. Knowledge networks are readily formed by users of social media as they create, modify, and interact with other UGC placed on the Web or within a specific community of practice.

D. PREVIOUS RESEARCH CONCERNING SOCIAL MEDIA USE IN HA/DR EVENTS

As social media and use of the Internet has proliferated, research concerning the use of social media in HA/DR events has seen a parallel increase; several studies specifically investigated the use of APAN during the Haiti earthquake of 2010. Taking a wide view of Web sites that were accessible to the general public, Paul (2001) investigated 64 disaster relief web sites and rated them using seven criteria related to user interactivity. She distinguished between the effort users of a site must exert to be active on the site and the effort producers of web sites must exert to *reduce* the effort required by users. Reducing the effort required by users to be active participants potentially allows for greater interactivity between the users and the creators of the web site or the disseminators of information.

Qu et al. (2011) discuss the use of social media in response to major disasters. Specifically, they assert the credibility of sources of information within the general public is questionable and requires a mechanism to vet the information. They also found that much of the information is redundant and frequent updates cause some information to sink or fade away... because tens or even hundreds of new posts are created every minute. Bui et al., in several papers concerning the systems used to organize an effective disaster response, also note the lack of quality data and, in some cases, the inability of international organizations to function as teams (Bui & Subba, 2009). Further problems may occur if various agencies are unsure about their role and go their own way without coordinating with others (Bui et al., 1999). Finally, Bui and Sankaran (2006) point out that military organizations often have a rigid communication hierarchy which may clash with non-military organizations and agencies. To counter some of these concerns Bui et al., argue for the creation of a Global Emergency Response System (ERS) or a Global Information Network (GIN) which can be utilized to coordinate efforts when disasters occur.

Yates and Paquette (2010) investigated how social media was used in response to the Haiti earthquake. Though they do not cite APAN directly, they did study the use of social media including Sharepoint (Microsoft) and MediaWiki (<http://mediawiki.org>). They found several challenges associated with social media, particularly due to the deluge of information available from participants. Some media grew unwieldy due to an inability to maintain control over the flow of information which increased the workload for already overtaxed responders. Moreover, they note that “the accuracy of information... needs to be constantly checked and validated which is very difficult given the amount of data that can flow into these systems” (Yates & Paquette, 2010, p. 8). When properly managed however, social media enabled effective knowledge management in an HA/DR environment by allowing multiple organizations to participate and “crowdsource” ideas from numerous experts simultaneously (Yates and Paquette, 2010).

Research conducted by Goggins, Mascaro & Mascaro focuses specifically on forum posts created in APAN during the Haiti earthquake. Their goal was to determine

what kinds of information and coordination occurred on the APAN Web site, how the information changed over time; and whether invisible brokerage could be detected in the data. In their analysis of the data, Goggins et al. (2010) had access to 5606 discussion threads and found that four percent (n=228) generated a response, 16 percent (n=898) were image uploads, and the remainder were what they termed standard format status updates. Their findings show that despite the fact that active posting on the site decreased over time, many users still accessed and read the existing information, implying that it still had value. They also assert that identifying brokers is important to sustaining each of the key communication topics and the benefits to areas struck by disaster are likely to increase if the key players can be identified (Goggins et al., 2010).

Finally, several studies analyzed the Haiti HA/DR APAN data from a different perspective. Beas & Lysne (2011), Hutchins (2011; 2012), and Trainor & Johns (2011) analyzed the collaborative information exchanges for the Haiti humanitarian assistance/disaster relief effort by applying definitions of the macrocognitive processes included in a model of team collaboration. This research focused on the cognitive processes entailed in sensemaking, managing uncertainty, and related cognitive processes entailed in responding to emerging events that occur in dynamic decision-making situations. The goal for the research was to understand the role of cognition in teams who are collaborating to solve unique, challenging, information-rich problems. Results indicate the task environment will influence which macrocognitive processes are used and evidence was found for several additional macrocognitive processes. The vast majority of team members' information exchanges concerned *Team Information Exchange* highlighting the importance of this process. The category with the second highest percentage of thought units was *Request Take Action* (RTA) – a subcategory of Decision Making.

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III. METHODOLOGY

A. RESEARCH FOCUS AREA

This thesis reports on an analysis of communication data from the APAN Web site (<https://community.apan.org/>) following the Haiti earthquake of 2010 and the HA/DR efforts which took place during the following months. Communications analyzed for this research include 1396 forum posts and 3900 web-logs created between January 13 and June 3, 2010. This data was obtained from USSOUTHCOM and the Distributed Information Systems Experimentation (DISE) group at Naval Postgraduate School, Monterey, CA. Permission to analyze the data was granted by the Naval Postgraduate School Institutional Review Board for the Protection of Human Subjects with the concurrence of SOUTHCOM. The forum posts came in a Microsoft Structured Query Language (MSSQL) database and was converted to Microsoft Excel to facilitate manipulation and display of the data.

B. DATA PREPARATION

Once the data had been converted to Microsoft Excel format it was sorted in several ways for various purposes. Data was sorted by thread number, by date and time, and by organization. Sorting the data by thread allowed discreet threads with multiple posts to be grouped together regardless of postdate. This facilitated following a distinct topic from inception to completion. Further, sorting the data into threads was necessary to facilitate both qualitative and quantitative analysis.

The data was also sorted by organization which provided the number of individuals and organizations utilizing the APAN HA/DR forum during the Haiti HA/DR operation. Additionally, sorting by organization provided a way to quickly determine which organizations were the most prolific posters and which were only interested in specific pieces of information.

Before coding could begin, each thread was separated into posts and each post was separated further into sub-units representing a distinct concept or thought unit.

Thought units may be as short as a few words or as long as several sentences but they share the characteristic of containing one thought. Weldon, Jehn and Pradham (1991) define a thought unit as “the sequence of a few words conveying a single thought.” After the posts were separated into thought units, the author coded each thought unit for purpose and type of post.

C. CODING

Open coding of the APAN Haiti forum data was conducted for this research. Open coding, also known as line-by-line coding, involves determining a category for the thought contained in each line. The goal is to build a descriptive, multi-dimensional preliminary framework for later analysis (Strauss & Corbin, 1998). Assigning a numeric value and category to the thought unit allows the qualitative data to be analyzed using quantitative means; the categories assigned to the individual thoughts can be counted and compared to the overall body of data.

Axial coding is the process of relating coding categories and sub-categories to each other allowing the regrouping of data in new ways. In this research, axial coding was not necessary as the author had determined prior to coding two distinct coding categories would be utilized: purpose of post and type of post. Selective coding involves determining the primary coding category and relating all other sub-categories to the primary category. Selective coding was not conducted as the categories that emerged during open coding each had individual merit and no one category was deemed primary.

1. Practice Coding

Prior to coding the data analyzed for this thesis, the researchers conducted practice coding on a subset of the data. Seven threads reflecting various post densities, were chosen. Two threads contained only a single post, one thread contained a post with a response, three threads contained an initial post with four or five responses, and the last thread contained an initial post with 19 responses. Together these threads contained 163 lines which were coded independently by two coders. Following the coding session, the results were compared to determine if both coders agreed on the parsing of posts into

thought units as well as applying the definitions within each coding category. This training provided familiarization with the data and solidified the interpretation and application of the coding definitions within the minds of the coders.

2. Purpose of Post

The first coding category involved the purpose of the post. During this portion of the coding, the coder determined why the post was created: did the participant issue a query, or a request for information; reply to a query; “push” information out to other users of APAN; broker information by connecting people; or have some other purpose. Based on a review of the research literature the author derived a list of purposes typically engaged in during collaborative problem solving. Table 3 lists the purposes and their definitions.

Table 3. Definitions of Purpose of Post used for Coding APAN Data for the Haiti HA/DR Operation

Code		Definition
1.	Query / RFI	“Any information flow that occurs as a result of a conscious initiation by the user” and is therefore expected (Cheverst & Smith, 2001, p. 3). Initiation of this flow of information can take the form of a query or simply ‘surfing’ the Web and discovering relevant information.
2.	Response to Query / RFI	The act of sending information in response to a specific request for information or query. The response forms the second half of a closed loop communication (Bian, et al., 2008; Dudfield, 2009).
3.	Information Push	“Any information flow that occurs which is unexpected by the user” (Cheverst & Smith, 2001, p. 3). This could be information that is sent in anticipation of a user's need, or in the case of a response to a query, if the response includes information not directly solicited by the requester.
4.	Information Brokering	The connecting of users who may not know each other by “connectors” or people who know where experts and ideas reside and who can serve as intermediaries between those users (Hansen & Nohria, 2004).
5.	Miscellaneous	Content not fitting into one of the above categories. Ex: Acknowledgements, “Thanks,” or other non-task relevant posts.

Simply seeing information requires no interaction with other participants and there is no forum post to indicate when it has occurred. Therefore, it was not possible to determine when a user engaged in a simple information pull since information pull is non-interactive. Other researchers have been able to ascertain information pull from Web site tracking data. Brazelton and Gorry (2003) refer to this as “lurking” while Goggins et al. (2010) characterize the reading of content as information consumption rather than lurking. In contrast to an information pull, a query occurs when specific information is solicited in the form of a natural language question, and the desired result is an *answer* that is complete in and of itself (Bian, Liu, Agichtein, & Zha, 2008). The question and its corresponding answer form a closed-loop communication and are indicative of interaction. Closed-loop communication involves “the exchange of information between a sender and a receiver irrespective of the medium.” (Dudfield, 2009) Closely related to the query is a request for information (RFI). An RFI does not necessarily take the form of a question but still conveys the requirement to gather information.

Information push includes both information exchange as well as knowledge sharing. Recall that information is data that has had some specific meaning imparted to it, such as numbers being combined to form a latitude/longitude coordinate or a phone number. Knowledge is the understanding of the relationships between pieces of information and sharing that knowledge may involve the sharing of interpretations or explanations of the information. Prior to coding, it was anticipated that the communications of a diverse group of participants collaborating during an HA/DR event would reveal evidence of information push.

After a review of the disaster relief literature, especially Qu et al., Goggins et al, and Yates and Paquette, it was further anticipated that there was a need for a coding category within purpose of post known as ‘coordinating activity.’ This category would represent coordinating efforts either on the ground or coordinating between personnel or

materiel en-route to Haiti. After analyzing the data, it was decided that coordinating activity was too narrow of a category and those posts which indicated coordination was taking place would be coded within the information push category.

Information brokering can be thought of as a subset of information push, however, due to its importance, a separate category of purpose was deemed necessary. Brokering is the act of connecting an information requestor with an information provider by an intermediary. It is significant to note that the requestor and provider are not initially aware of each other and it is through the actions of the intermediary that the two are connected and relevant information or knowledge can flow between the two.

The final coding category under purpose of post was the miscellaneous category. Thought units that do not fit in one of the other categories such as greetings, acknowledgements, and other non-task related thought units are coded in this category. Table 4 provides examples from the data of the categories concerning the purpose of the post.

Table 4. Examples of Purpose of Post Used for Coding APAN Data for the Haiti HA/DR Operation

Code		Examples From APAN Forum ^{Note 1}
1.	Query / RFI	Are there shapefiles for the relief slides you have posted?
2.	Response to Query / RFI	Please go to the following link: www.intelink.gov/.../haitiearthquakejanuary2010geoointsupport [] and navigate to all the geospatial products, you will find kml files with the information you are requesting.
3.	Information Push	We arrive in Cape Haitian 1/30 and will be leaving 2/7. Will go where most needed.
4.	Information brokering	Possible solution may be here for your hospital. JTF Haiti has established the humanitarian assistance coordination center HACC.
5.	Miscellaneous	Thank you for your efforts on the ground

Note 1: Some elements of the original data have been formatted to aid in readability (i.e. posts in mixed capital letters were changed to sentence case and proper names and phone numbers have been removed).

3. Type of Post

Type of post pertains to the qualities or attributes of the post that indicate what kind of information it contains. Preliminary coding indicated there was a distinction between purpose of post and type of post. Similar to coding for purpose, categories were derived from the disaster relief literature including works by Qu et al., Goggins et al., and Yates and Paquette. The system related category emerged during practice coding. In contrast to purpose, the type of post category involves the type of information a post contains vice why the post was created and includes the seven coding categories listed in Table 5.

Table 5. Definitions of Types of Post used for Coding APAN Data for the Haiti HA/DR Operation

	Code	Definition
1.	Opinion	Posts in which the poster expresses a view or judgment of something which is not necessarily based on fact or first-hand knowledge (Qu, et al., 2011).
2.	Situation Update	Posts containing new information about events in support of Haiti HA/DR operations, or personnel or materiel en route to Haiti (Qu, et al., 2011).
3.	HA/DR General Input	Broad category of posts in which HA/DR related information is either pushed or pulled as a means of explanation, providing background information, or other knowledge not contained within one of the other categories (Qu, et al., 2011).
4.	Action Related	Posts requesting some specific action be taken.
5.	System Related ^{Note 1}	Posts which deal with some aspect of the hardware or software of the APAN Web site (category emerged during coding).
6.	Emotional	Posts expressing feelings deriving from the poster's circumstances, mood, events taking place, or their relationships with others (Qu, et al., 2011)
7.	Other ^{Note 2}	Posts that do not fit into one of the above categories.

Note 1: As users become familiar with a new technology, they may devise procedural improvements or formulate requirements for new capabilities related to the system itself.

Note 2: The types of posts classified in the 'other' category include such posts as acknowledgement of the receipt of some information, expressing thanks, or other non-task related posts.

Examples from the APAN data that are indicative of the type of post are found in Table 6.

Table 6. Examples of Type of Post Used for Coding APAN Data for the Haiti HA/DR Operation

	Code	Example From APAN Forum ^{Note 1}
1.	Opinion	In my opinion, Haiti needs SSSTR [Stability, Security, Transition, and Reconstruction] operations to run smoothly, accurately and with as many services available.
2.	Situation Update	EFFECTIVE IMMEDIATELY Hospital Sacre Coeur has surgeons and 5 operating rooms standing by for patients. Total capacity 300 patients plus rehab.
3.	HA/DR General Input	I have a shapefile of these distribution sites I can e-mail you.
4.	Action Related	If someone has a way to pick it up, ship it and install it in Haiti please feel free to call "X" at xxx-xxx-xxxx
5.	System Related	If you are still getting too much mail, go back and uncheck the remaining "notifications" boxes one at a time.
6.	Emotional	Our thoughts and prayers are with the Haitian people and all those affected by this devastating earthquake, said U.S. Army Col.
7.	Other	Many thanks!!

Note 1: Some elements of the original data have been formatted to aid in readability and privacy (i.e. posts in mixed capital letters were changed to sentence case and proper names and phone numbers have been removed).

D. INTER-RATER RELIABILITY

For this research the APAN data was parsed into thought units and then coded for content. When a body of data is coded by applying definitions of multiple coding categories, the process is potentially subjective in that the coder, also known as a rater, may interpret the definitions included in the coding scheme differently. One way to check for subjectivity is to have multiple raters independently code the data. This allows the results of the two raters to be compared to determine how consistent they were in applying the definitions of the coding categories to the data and to determine the reliability of their analysis and coding. The inter-rater reliability score quantifies the closeness of scores assigned by a pool of raters to the same study participants; the closer the scores, the higher the reliability of the data coding method (Gwet, 2012).

The most basic form of the inter-rater reliability score is known as the probability of agreement: $Pr(a)$. This can be calculated by adding the number of times the raters agreed on a code assignment within each category and then dividing the sum by the total number of cases or items coded. There is discussion in statistics literature that states there is a probability that raters will agree merely through chance and therefore, the probability of chance agreement should be removed from the overall percentage of agreement (Gwet, 2012). To calculate the probability of chance agreement, notated by $Pr(e)$, the number of times the first rater assigned a code within a category must be multiplied by the number of times the second rater applied the same code within the category. This must be done for each category. The resulting product for each category should then be added to form a total. The total of the products is then divided by the number of cases squared.

1. Cohen's Kappa Coefficient

Several methods can be used to measure agreement among raters and for this research Cohen's kappa coefficient was used. The kappa statistic represents the proportion of agreement between the raters that remains after chance agreement is removed. This method provides a more accurate measure of agreement than other proportional agreement methods. Once $Pr(a)$ and $Pr(e)$ are known, Cohen's kappa

coefficient can be calculated by subtracting $\Pr(e)$ from $\Pr(a)$ and dividing the result by one minus $\Pr(e)$. The equation for Cohen's kappa coefficient is shown in Figure 4.

$$K = \frac{\Pr(a) - \Pr(e)}{1 - \Pr(e)}$$

Figure 4. Formula Used to Determine Cohen's Kappa Coefficient (κ)

After coding was complete, the coding results were used to calculate the kappa coefficient. Landis and Koch (1977) suggest a standard for determining the quality of the kappa value which is shown in Table 7.

Table 7. Agreement Measures for Categorical Data (From: Landis and Koch, 1977)

Kappa Value	Strength of Agreement
<0.00	Poor
0.00-0.20	Slight
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Substantial
0.81-1.00	Almost Perfect

E. NETWORK DIAGRAMS

A network diagram graphically depicts the connections between actors in a given thread to visually represent the way information flowed between participants. Users of a collaboration system are said to be connected when they submit a query or push information via a forum post and another user supplies a response or comments on the preceding post.

At the top of each network diagram, the thread identification number, thread topic, and total number of posts within the thread is indicated. Individuals are depicted by circles in the diagrams and their organization and user identification numbers are

included (to differentiate between multiple users within the same organization). A date is also included to indicate when a poster first became active within the thread. The initial poster of a topic is typically depicted in the central circle and denoted with a “1.” Lines are used to indicate a connection between two posters of information; arrows are used to indicate the direction of information flow. Time (when available) and date of post are indicated near the lines to aid in understanding how quickly each post or response was generated. In cases where a thread has been dormant for several days or longer and an individual re-activates the thread, the line is longer to indicate the time elapsed between posts.

In threads with multiple interactions between participants, network diagrams can also aid in identifying prominent individuals within the group. Those individuals with the most interactions will typically be centrally located and have the most connections with other individuals. Peripheral individuals may only be loosely connected to the network of a given thread, however, the value of their knowledge or input to the network cannot be judged solely by the diagram.

Network diagrams depict the interaction between individuals on a specific topic and it was beyond the scope of this study to analyze how organizations interacted across multiple topics. Also, no effort was made to analyze the degree of connectedness or “betweenness” of the various individuals and organizations, as that too, lies outside the scope of this research. Finally, diagrams are arranged spatially in an effort to deconflict the lines showing connections as much as possible; there is no significance of the arrangement of individuals or lines other than what has already been noted.

A sample network diagram, shown in Figure 5, illustrates how the thread was depicted and the information arranged. Thread 8553 began on January 26, 2010 at 0543 GMT. Hospital Sacre Coeur created the initial post under the heading, “Jan 26: Hospital Sacre Coeur, Milot, Haiti has Capacity for More Surgery Patients.” The originator provided details regarding the facilities available along with the location of the hospital and notes that they did not receive any helicopters with patients despite having an operating helo pad adjacent to the hospital. At 1130, Defense SA Div (a division of SOUTHCOM) responded to the post with information concerning a point of contact

(POC) at the Humanitarian Assistance Coordination Center (HACC) and followed up at 1131 with more detailed information concerning the correct extension to contact. At 1559, an individual with Telecom Rapid Response Consulting responded to the original post requesting the poster to contact him at the phone or e-mail provided. The final post in this thread occurred at 1620 when an individual at SOUTHCOM thanked the original poster for the information and requested a follow-up post if the situation changed.

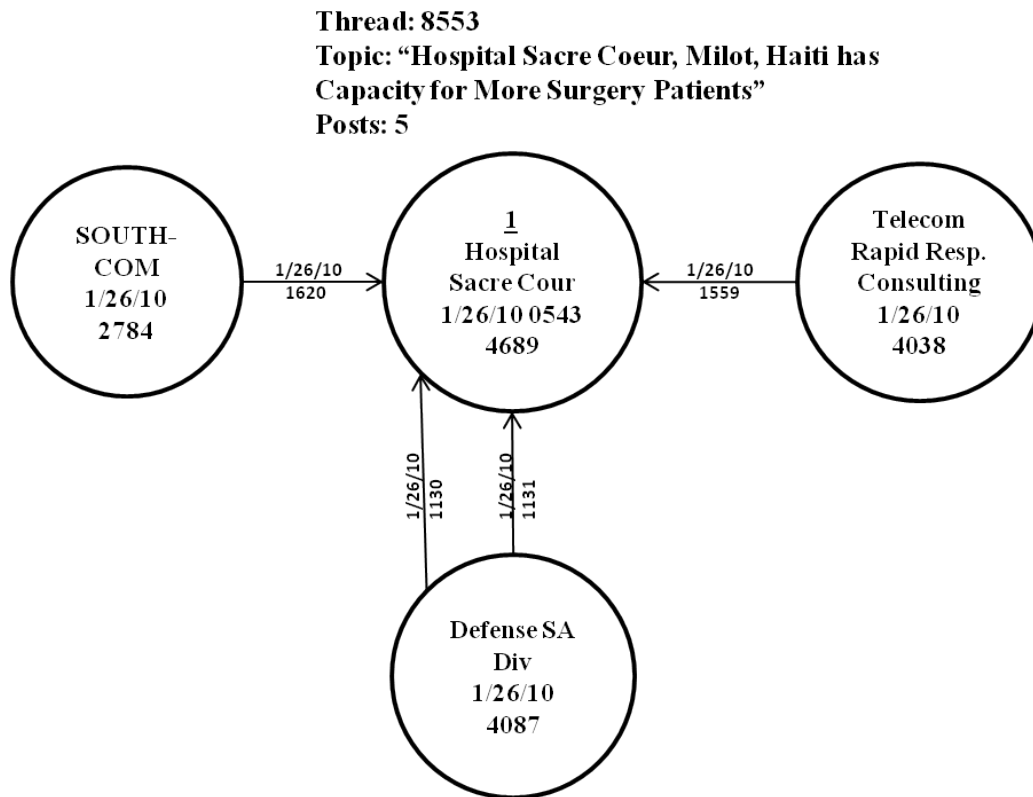


Figure 5. Sample Network Diagram for Thread 8553: Hospital Sacre Coeur, Milot, Haiti has Capacity for More Surgery Patients

IV. RESULTS AND DISCUSSION

A. OVERVIEW

The data analyzed for this thesis consisted of 722 threads that transpired during the Haiti HA/DR operation. The threads contained 1395 forum posts that ranged in date from January 13, 2010, less than 24 hours after the earthquake occurred, to June 3, 2010, which represented the conclusion of major U.S. military operations in Haiti. Parsing the posts into thought units resulted in a total of 669 thought units to be analyzed and coded. Coding was done to ascertain the purpose of the post as well as type of post. The threads that contained at least one response were coded for purpose of post and type of post. Single posts without a response were analyzed to determine the type of information they contained and they too were coded for purpose. Coding can be subjective; it is therefore good practice to have multiple coders code the same data set. In this case, a sample of 271 thought units was coded by a second rater to measure inter-rater reliability.

B. CHARACTERISTICS OF THE POSTS

To aid the reader's understanding of the relationship between the number of posts and number of threads, pie charts were developed as an initial way to describe the data. The chart in Figure 6 depicts the number of posts per thread as a percentage of total threads. Each segment represents a thread with a number of posts, where the size of the segment depicts how often a thread with that specific number of posts appears in the data. For example, of the 722 total threads, there were 559 single posts and 48 threads with two posts, or an initial post and a response. The threads with two posts represent seven percent of the total number of threads. At the other end of the spectrum, there was only one thread with 33 posts, representing less than one percent of the total threads. While the majority of threads did not receive a response, this alone does not accurately depict the nature of the collaboration which occurred via the APAN Web site as the majority of these single posts involved a push of information, a situation update, or imagery which did not merit a reply.

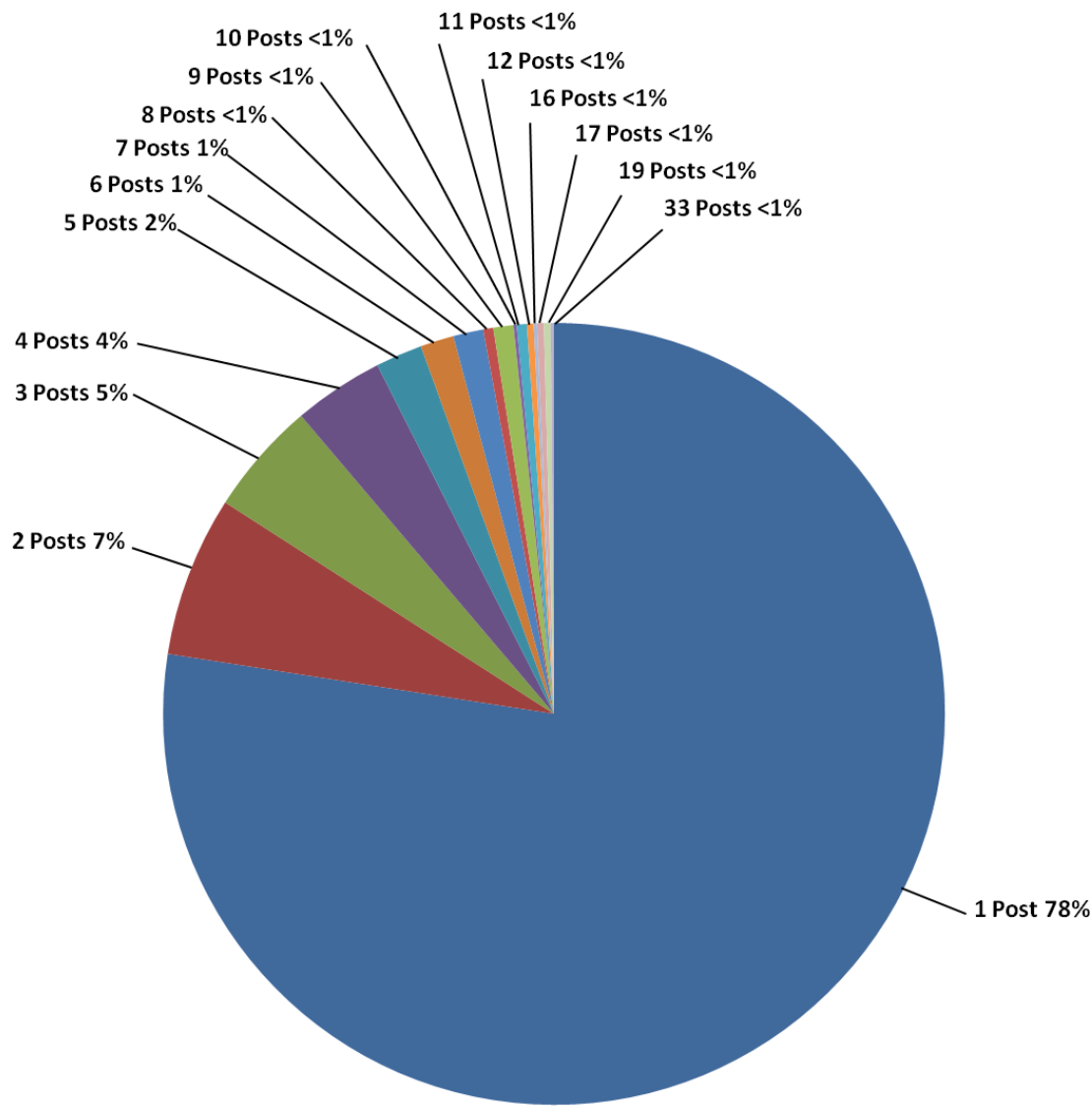


Figure 6. Number of Posts per Thread as a Percentage of Total Threads

The chart in Figure 7 depicts the number of posts per thread as a percentage of total posts. Each segment again indicates a thread with a specific number of posts however, the number of posts per thread is compared to the total number of posts. Fifty-eight percent of all of the posts were part of an exchange vice a single post with no response. This comparison more accurately reflects the nature of the interaction taking place as the majority of the posts were part of an interactive exchange of information.

However, this is not meant to imply that single posts did not involve an exchange of information, as there is no doubt that the single posts were read by many people as well.

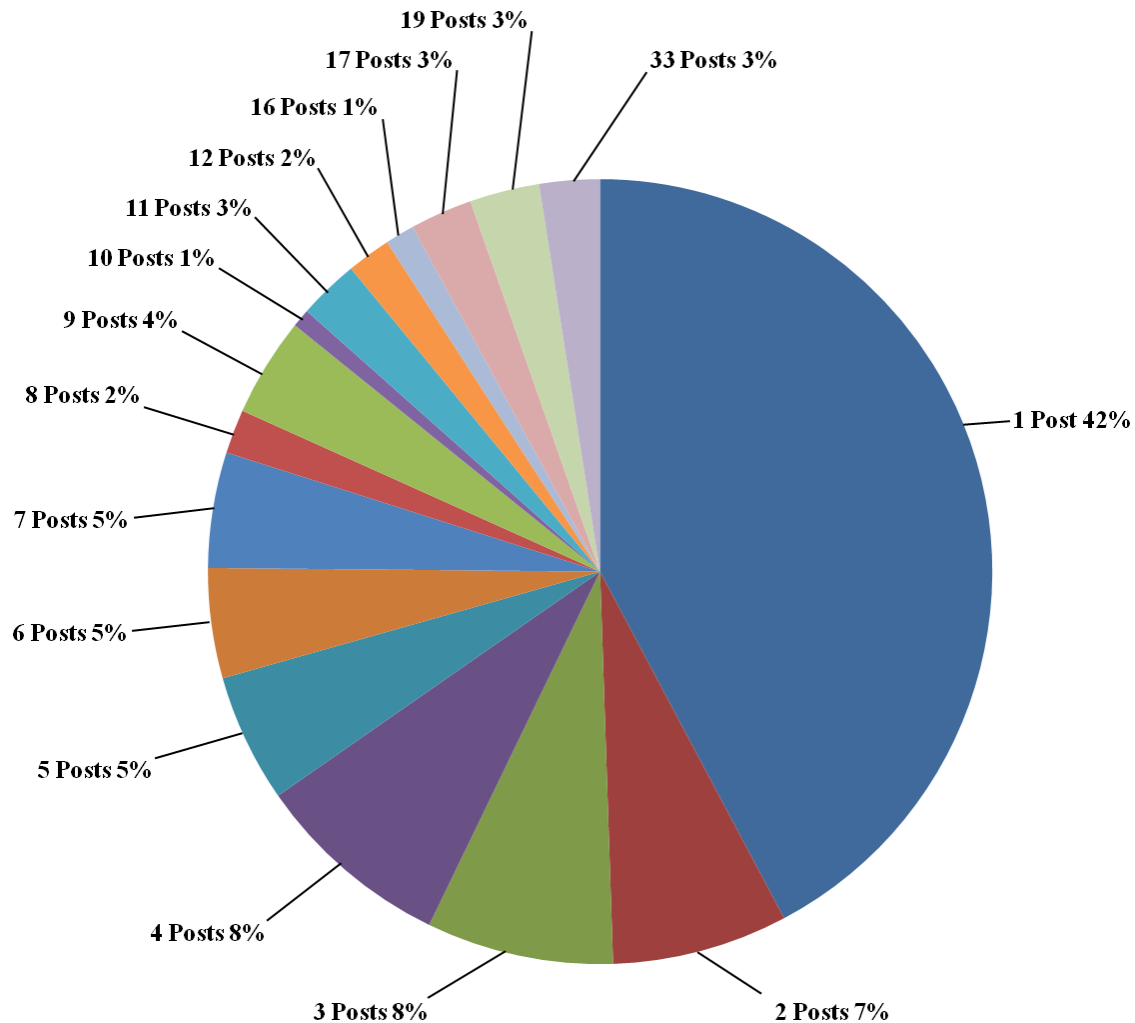


Figure 7. Number of Posts per Thread as a Percentage of Total Posts

C. CONTENT ANALYSIS OF THE SINGLE POSTS

Prior to obtaining the APAN data for this study, a filter was applied to the data to remove empty threads and posts with images. The remaining data comprise the data that was analyzed for this research. Analysis of the forum threads indicates that 78 percent (n=559) contained a single post with no reply or response. This finding is in line with Goggins et al. (2010) who also analyzed data from the APAN forums: Of the 5606

threads they analyzed, 5378 posts, or 96 percent, received no response. Of that number, 898, or nearly 17 percent were image uploads and they categorized the remaining 4480 single posts as “standard format status updates.”

To determine the type of content of the single posts, further analysis was conducted. During initial coding, 13 distinct categories emerged which encompass the majority of the posts and a 14th category, labeled other, was created to capture the remaining posts. The 14 categories that represent the content of single posts are depicted in Figure 8. The majority of single posts contained a single type of information which allowed them to be coded for a single category. It should be noted though, that posts exist which contained several types of information. These received codes for multiple categories.

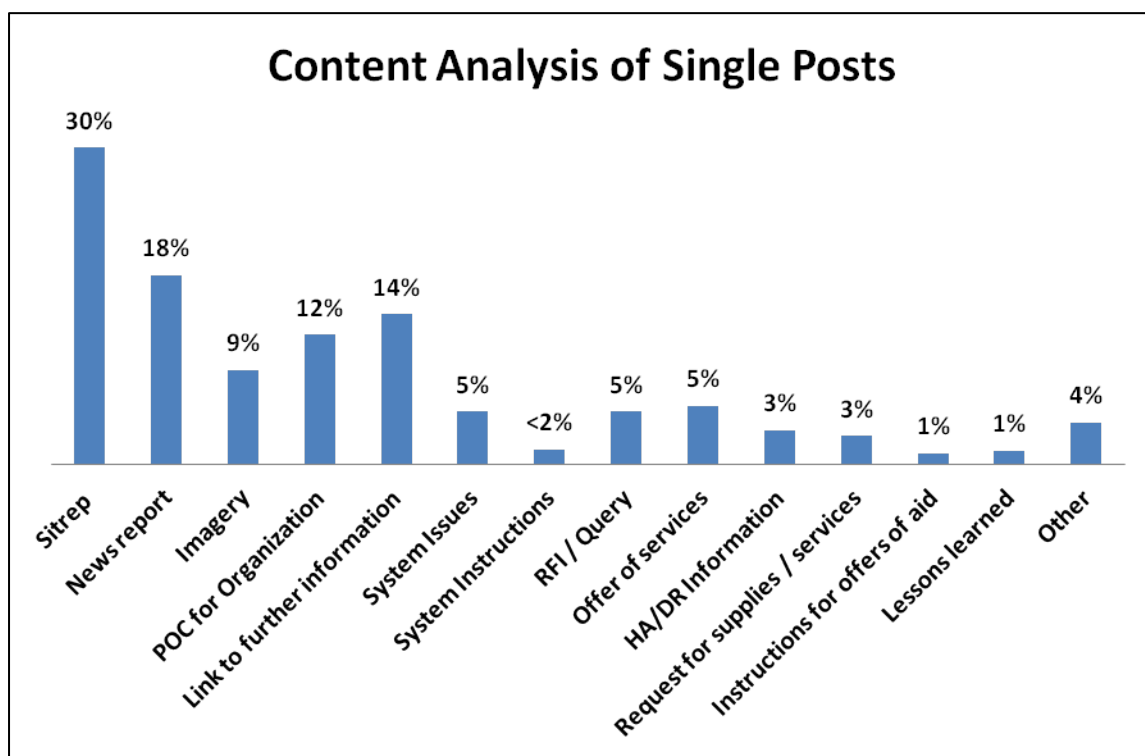


Figure 8. Percentage of Threads Containing a Single Post Coded by Type of Content (n=559)

1. Sitreps, News Reports, and Links to Imagery

Similar to the Goggins et al. data, the majority of posts with no response in this data were situation reports, copies of news reporting, or links to imagery. There were 169 situation reports, 101 news reports, and 50 links to imagery products. Taken together, these three categories of posts represent 45 percent of all of the codes assigned to threads consisting of single posts. Many of these posts were written to provide a link for further information or a situation report. Those posts that did contain information were typically copied verbatim from news reporting. News reports were not parsed into thought units.

2. Links and Points of Contact

Eleven percent of the single posts (n=79) consisted of either a link to additional information or contained other information along with a link to a different Web site. In several cases, the linked Web page was part of the APAN site such as a wiki or blog post. In addition to links to further information, just under 10 percent of the posts (n=69), provided POC information concerning a person or an organization. Most often, POC information was given along with an offer of assistance or in conjunction with an RFI or request for service; however, there were several cases where an organization simply posted their name, contact phone number, and Web site.

3. Offers of Services, Requests for Services, and Queries

Six percent of the single posts (n=31) contained an offer of services or materiel for use by the Haiti HA/DR responder community. While the majority of the offers contained either a POC or a link to an organization's Web site for more information, in those instances where the post did not include POC information, the posters were apparently relying on interested parties to respond via the APAN forum. Three percent of the single posts (n=15) contained a request for supplies or services. The requests included the need for more food, water, medicine, transportation availability, shelters, as well as the need for security personnel, or in one case, an echocardiogram. Twenty-nine posts contained queries or other requests for information that went unanswered in the forum. Fourteen of those had POC information listed in the body of the post while 15

did not. It is possible that these questions were answered outside of the APAN forum community either by e-mail, phone, or some other means of communication that could not be easily tracked.

4. System Issues and Instructions

Six percent (n=36) of the single posts were related to the APAN system use or instructions for its use. Twenty-eight of those were systems issues involving problems, errors, or concerns with the APAN system and eight were instructions on how to operate within the APAN environment. As the usage of APAN during the Haiti HA/DR operation was meant to be a trial and not a live demonstration, usability issues were to be expected and instructions to aid the APAN user community were necessary and forthcoming. However, a certain percentage of system related posts will always be present as technology advances and new users join the community.

5. HA/DR Information, Instructions, and Lessons Learned

Three percent (n=18) of the single posts were categorized as providing HA/DR information, or best practices, sent by members of the APAN community to aid others with specific tasks or to provide general knowledge about disaster response situations. This type of knowledge transfer is indicative of the knowledge steward or “someone who collects knowledge” (Gladwell, 2000) and desires to share it. Six of the single posts contained instructions on how to accomplish a specific task or provide a service. Five of the six were transportation related and the remaining post provided instructions for requesting a frequency range for communication equipment. As the disaster response transitioned from short-term issues to longer-term rebuilding and recovery, there were seven posts which provided lessons learned including how best to use and share imagery, how best to share information using social media, and links to reports given to international partners on how best to handle civil-military relations.

6. Others

The final category of the single posts was for those that did not fit into one of the previously defined categories. Four percent of the single posts (n=22) include

information that was not coded in one of the other categories. Examples of these posts include a listing of common first responder phrases in several languages, an offer of online courses concerning the history of UN peacekeeping, lists of hotels in the Miami area for visitors to SOUTHCOM, user tests of the system, as well as others.

7. Comment on the Single Posts

As can be seen from the content analysis of the single posts, many of the posts that did not receive a response still contained valuable information in the form of instructions, POC information, links, or information concerning offers or requests for specific aid. Due to the fact that this was the first time APAN was used in an HA/DR event in the SOUTHCOM area of operations (AOR), organizations involved may have posted information for the community and then followed up or responded to posts via more traditional means such as phone, e-mail, or face-to-face meetings. Further research would be required to determine if posters and readers of posts within the community used other means to communicate. It is postulated other means of communicating were frequently used since many times phone numbers and e-mail addresses were exchanged. One explanation for this frequent use of other communication modalities is that they provided either a more personal connection, such as hearing the person's voice, or they provided a one-on-one connection to finalize plans.

D. CONTENT ANALYSIS OF THREADS AS PART OF AN EXCHANGE

Twenty-three percent of all of the threads (n=163) included one or more responses. An interactive exchange of information occurred any time a post received at least one response. Nine percent of these threads (n=15) were divided into their component thought units to better understand how information was transferred between users and what types of information were transferred. A total of 669 thought units were coded to determine the purpose of the post as well as the type of post. These two categories explain why a post was created and what kind of information it contained. Examples from APAN are provided to elucidate the posts that were coded for each category.

1. Purpose of Post

Table 8 presents the number and percentage of thought units in each category of purpose of post.

Table 8. Number and Percentage of Thought Units Coded for Purpose of Post (n=669)

	Purpose Categories	Total Thought Units Coded (n)	Percentage of Thought Units
1.	Query / RFI	111	16
2.	Response to Query / RFI	110	16
3.	Information Push	293	44
4.	Information Broker	73	11
5.	Miscellaneous	89	13

a. Query or RFI

Sixteen percent (n=111) of the thought units were coded as representing a query or RFI. To be included in the query / RFI category, a user must have asked a direct question or requested specific information. Often in the knowledge management literature, a query is the first part of an information exchange. Table 9 provides examples of thought units coded as a query or RFI.

Table 9. Examples of Thought Units Coded as Query or RFI

	Date / Time	Organization	Query of RFI
1.	1-27-2010-6-48	Risk Magement Intertiol Mission Board IMB	Does anyone have a contact or location of tent supplies?
2.	1-17-2010-23-57	SOUTHCOM	What is the security situation in the various sectors of PaP? Outside of PAP [Port-au-Prince]?
3.	1/14/2010	SOUTHCOM	Do we have ground truth on the ability to move ha/dr supplies into PaP IAP?
4.	1/14/2010	Evergreen International Airlines	Can anyone provide any information regarding the Airfield lighting? Runway AND TAXI? ARE THESE SYSTEMS OPERATIONAL?
5.	1-31-2010-6-34	National Defense Government of Canada	Does anyone know the status of media in Leogane or Jacmel areas?

b. Response to Query / RFI

Sixteen percent (n=110) of the thought units were coded as a response to query or RFI. The response to a query or RFI is the second part of information exchange and is required for closed-loop communications. To be effective, a response must be timely and provide information relevant to the requester. APAN allowed a diverse community of participants representing a wide range of organizations to respond rapidly to posted queries and RFIs. Posting responses in the forums allowed other members of the community to view these responses potentially answering their own questions and in general, increasing the situational awareness of these participants.

When combined, the query / RFI and response to query / RFI categories accounted for 37 percent of the codes assigned regarding purpose of the post. The closeness of the values of these categories is expected as community members attempt to respond to and answer questions other members might have. Any disparity between the

number of queries / RFIs and number of responses may reflect a situation where a participant might ask multiple questions in a single post and may receive a single response. Table 10 provides examples of thought units coded for response to a query or RFI.

Table 10. Examples of Thought Units Coded as Response to a Query or RFI

	Date / Time	Organization	Response to Query or RFI
1.	1-16-2010- 20-39	J73 USPACOM	This is a capability which does not presently exist, but we have heard the request before.
2.	2/24/2010	N2 COMUSNAVY	[Name], have you tried Google maps with the "more options" "pictures" selected?
3.	2-24-2010- 10-02	Field Director Caribbean Missions	You might check with missionaryflights.org in Fort Pierce, FL.
4.	2-25-2010- 6-29	J73 PACOM	[Name], the following forum thread contains some links to sites you can use to acquire imagery.
5.	3/12/2010	GEOINT SOUTHCOM NGA SUPPORT TEAM	I hope this is what you are looking for.

c. Information Push

Thirty-nine percent (n=258) of the thought units were coded as information push, representing the largest category for purpose of post. This result was expected as in any novel situation or highly dynamic environment, the participants need to provide other participants with information concerning the situation within the disaster area. The benefit of using a social media site like APAN is that the information exchanged can be instantly transmitted to the entire community of users. This has the potential to reduce information gaps, minimize confusion, and maximize the coordination and cooperation taking place.

Prior to coding, it was anticipated that categories for logistics and coordinating support activities would be included in the coding scheme. Logistics and coordinating support are similar to brokering, in that they entail using the collaboration site to achieve a result not easily achieved through other means. Once coding commenced, it was determined that these categories did not add to the understanding of the overall use of the APAN Web site and the thought units which had received codes in these categories were included in the information push category. Table 11 provides examples of thought units coded as information push.

Table 11. Examples of Thought Units Coded as Information Push

	Date / Time	Organization	Information Push
1.	1/16/2010	Technical Consultant UN SPIDER	There are various products posted to www.disasterscharter.org, and a ton of stuff flying by of the crismapper google group initiated by un-ocha.
2.	1/16/2010	DoD USTRANSCOM	Folks on the ground in Haiti indicate that, at least in the area of PaP, T-MOBILE IS ACCESSIBLE AND FREE.
3.	1/17/2010	inSTEDD	Since I havent been able to reach them, i also have started a parallel thread to address situation since it is mission critical.
4.	1/17/2010	Barbary Services LLC	If not available- try also jumbo bags/super sacks/ib bags. Should be available in DR - used in sugar/commodity trade - check with commercial port/shipping community.
5.	1/17/2010	NDU	For partners in this network with iphones: two gis experts have just released a free iphone app that for *disconnected* access to Haiti Digitalglobe 1m resolution, Geoeye .5m resolution updated on 1/13, andopenstreetmap constantly being updated, hourly and some data in 1 minute increments.

d. Information Brokering

Evidence of information brokering was found in eleven percent (n=73) of the thought units. Information brokering represents one of the most interesting categories and potentially a critical component for the success of a social media forum community. The essential purpose of a forum is to share information and more importantly, to create connections between users that cannot be readily formed through other means. Often a connection was made by simply posting a link to additional information in response to a query while other times a member specifically posted another member's or organization's contact information in response to a request for information. Table 12 provides examples of thought units coded as information brokering.

Table 12. Examples of Thought Units Coded as Brokering

	Date / Time	Organization	Information Brokering
1.	1-18-2010-17-24	Development The Millenium Group Intl	Below are the numbers for the Digicel operations manager. 0050936054072 Digicel 0050934902253
2.	1-25-2010-9-37	Telecommunicati ons Rapid Response Consulting	If medical supplies are being donated, i have these Red Cross contacts that may prove of value.
3.	1-27-2010-16-09	Hillside Church	Shelterbox at srt@shelterbox.org or their main website was stationed in Delmas near the UN minustahs area. They have 10 men tents, suggest you try [name] or [name] on the ground there.
4.	1/31/2010	Volunteer-CERT-Hollywood-	I wanted to tell you about two small groups who have flown from south florida transporting medical supplies and medical personnel. They say they are going AGAIN.. One is Pinson Foundation. Contacts are [name] 727-45x-xxx, 813-85x-xxx who is in Haiti as of today.
5.	2/4/2010	Water and Wastewater CE2 Engineers	Aircraft owners and pilots association AOPA can help you find private or business aircraft owners willing to do this. their contact information is: FREDERICK, MD 21701 phone 800/87x-xxxx Fax 301/69x-xxxx

e. Miscellaneous

The miscellaneous category captures all of the thought units that do not fit within the other categories, such as non-task related material, acknowledgements, or appreciation for some act. Miscellaneous thought units accounted for 13 percent (n=81) of the thought units.

2. Analysis of Type of Post

Table 13 contains the percentages of thought units coded for the categories included for type of post.

Table 13. Number and Percentage of Thought Units Coded for Type of Post (n=669)

	Type Categories	Total Thought Units Coded (n)	Percentage of Thought Units
1.	Opinion	31	4.6
2.	Situation Update	45	6.7
3.	HA/DR General Input	325	48.6
4.	Action Related	45	6.7
5.	System Related	145	21.6
6.	Emotional	2	.2
7.	Other	76	11.3

a. Opinion

Five percent (n=30) of the thought units were coded as representing an opinion. Whenever people interact, they will either purposefully or inadvertently offer their opinions on the subject being discussed. Opinions are typically ideas about the subject that are not verifiable or based on facts. While this is not always negative, as in

the case of an expert describing what may or not work in a given situation, it can sometimes be a distraction. A possible explanation for the low number of codes assigned to opinion may be because APAN users were comprised of individuals representing organizations with experience in HA/DR situations who may realize that unverified information could lead to inappropriate use of personnel or materiel. Table 14 provides examples of thought units coded as opinions.

Table 14. Examples of Thought Units Coded as Opinions

	Date / Time	Organization	Opinion
1.	1/28/2010	Telecommunications Rapid Response Consulting	If NGOs and other organizations and service providers want to offer assistance for future requirements that are needed in Haiti, this is the perfect place to do so.
2.	1/17/2010	Telecommunications Rapid Response Consulting	In my opinion, imagery needed by teams focused on Haiti NGOs, Contractors, MULTI-NATIONAL TEAMS, ETC. SHOULD BE OF 10 METER ACCURACY SPECIFICATION and be published soon if not right now for many parts of the city and harbor and surrounding coastal waters.
3.	1/25/2010	Executive Emicus com	If there's 1 guy that is possibly alive, it should be an effort by anyone who can get there.
4.	1/31/2010	World Cares Center	APAN is not just intended to share information but to build communities and trust.
5.	2/18/2010	DIA	No doubt changing the interface at this point would be challenging, just as rearranging furniture becomes essentially impossible once folks are already sitting in the chairs.

b. Situation Updates

Situation updates accounted for 12 percent (n=44) of the thought units coded for type of post. Situation updates provide factual information about events taking place as the evolving situation in the HA/DR environment unfolded. Sharing information in the form of situation updates improves situational awareness in disaster response

efforts (Qu et al., 2011). To illustrate the difference between HA/DR general input and a situation update, the following quotes from APAN are provided: “No scheduled flight service into PAP [Port-au-Prince] yet.” This thought unit was coded as a situation update as it referred to a specific state of operations at the PAP airport. The following quote was coded as HA/DR general input as it provides information concerning a specific place but no other indication of the events occurring at the place: “Directions to Boutillier hill-north of Petionville, you take the route de Kenscoff, and before you reach Fermatre, it’s on your right.” Table 15 provides examples of thought units coded as situation update.

Table 15. Examples of Thought Units Coded as Situation Update

	Date / Time	Organization	Situation Update
1.	1/13/2010	OASD Networks and Information	Situation update from Logistics Cluster: initial reports indicate a high number of casualties and heavy damage to Port-au-Prince.
2.	1/14/2010	SOUTHCOM	*UPDATE on the NOTAM: A/O 1300EST 15 Jan 2010, the GoH has given airspace AUTHORITY TO THE UNITED STATES FOR 72 HOURS ENDING 1300EST 18 JAN 2010.*
3.	1/17/2010	NDU	The generator powering the PRIMARY Internet Exchange Point AHTIC for the island and the primary isp, believed to be multilinksa, has less than a days diesel fuel.
4.	1/17/2010	Telecommunications Rapid Response Consulting	Digicel update on situation in hHaiti [] the Digicel network is now functioning well in port-au-prince with more and more customers connecting to it and being able to make and receive calls, text messages, email messages and BlackBerry Messenger.
5.	1/20/2010	Oasis for Children	Although the children and workers are all ok they are still sleeping outside and have no water and very little food.

c. HA/DR General Input

The HA/DR general input category accounted for 48 percent (n=316) of the thought units analyzed regarding type of post. To avoid double coding with the categories included in purpose of post coding scheme, HA/DR general input includes thought units that provide general information or provide comments on previous posts. This category is differentiated from situation updates which provide information related to a particular occurrence or event. Table 16 provides examples of thought units coded as HA/DR general input.

Table 16. Examples of Thought Units Coded as HA/DR General Input

	Date / Time	Organization	HA/DR Gernerel Input
1.	1/14/2010	CPRW 11 Patrol Squadron One	The link for the state Dept Ops Center is HAITI.USEMBASSY.GOV/.../EMERGENCY-CONTACT.HTML
2.	1/15/2010	J73 PACOM	Ive created the first of these revised user guides for Creating a Blog Post []. I've tried to simplify it as much as possible to assume the reader has very little computer experience. this user guide is the bare-minimum needed to post a blog.
3.	1/16/2010	SOUTHCOM	Might want to also look at the UN logistics cluster web site and the RELIEFWEB SITE. IT HAS A NUMBER OF MAPS.
4.	1/18/2010	Hospital Sacre Coeur	Hospital Sacre Coeur in milot Haiti is appealing for patients. Need coordination to get helos to hospital. Full service hospital with 20 haitian drs, a us trauma (6) and orthopedic team (6) and with 35 nurses 17 more Drs and nurses scheduled to arrive from US 2 ors adequate medical supplies, clean water and electricity (generator) Local soccer field is landing pad.
5.	1/23/2010	Field Director Caribbean Missions	There is a list at the following link that might help in compiling YOUR data. www.missionaryflights.org/.../mfis-affiliated-m

d. Action Related

Nearly seven percent (n=45) of thought units were coded as action related. Action related thought units are those thought units that request a specific action to be taken and often result in actions being taken by others, to respond to, or address the issues and problems identified (Qu et al., 2011). Action related thought units range from simply asking someone to contact the poster offline to requesting a flight for surgical equipment bound for Port-au-Prince. An example of an action related thought unit follows: “We need diesel to be delivered to Boutilliers at Multilink/HAICOM site.” In this example, the user requested a specific commodity to be delivered to a specific place. In another example, personnel outside of Haiti requested POC information for coordination of disaster relief activity at a specified area in Haiti: “Please forward contact information for disaster relief efforts in Jacmel.” Table 17 provides further examples of thought units coded as action related.

Table 17. Examples of Thought Units Coded as Action Related

	Date / Time	Organization	Action Related
1.	1/15/2010	Navy Region SE	250 water purification units available in puerto plata dominican republic available for transfer to port-au-prince. if anyone has information to support, please contact [name]at 904 77x-xxxx.
2.	1/17/2010	NDU	We need diesel to be delivered to Boutilliers at Multilink/HAICOM site. you can contact either [name] 509-340x-xxxx or [name] 509-344x-xxxx.
3.	1/17/2010	SOUTHCOM	For urgent fuel shortage, contact [name] or [name]on the ground in Haiti. telephone number is 301-98x-xxxx. they will link the companies up with sol Haiti. sol Haiti will have two fuel terminal sites.
4.	1/18/2010	Southern Pulse	I have a client who needs to evac personnel from Jacmel. He has requested a briefing today at 1200.
5.	1/18/2010	SOUTHCOM	We have run out of antibiotics and analgesics. We have doctors and ors. We hear helicopters overhead all day. What i would really like to have is the email of a senior military doctor on the ground in port au prince who can break the logjam.

e. System Related

Twenty-two percent (n=142) of the thought units were coded as system related. The system related category contains thought units that were concerned primarily with the functionality of APAN or Web site traffic statistics regarding APAN use. As APAN was being debuted to SOUTHCOM, it was to be expected that there would be a significant number of system related posts. Unlike the analysis of the single posts, this category was not further broken down into problems or issues with the system and instructions for operating within APAN. Table 18 provides examples of thought units coded as system related.

Table 18. Examples of Thought Units Coded as System Related

	Date / Time	Organization	System Related
1.	1/17/2010	J73 USPACOM	While forum mailing offers a workaround, i think i have an idea that would be fairly easy to implement and slightly more direct.
2.	1/19/2010	J73 USPACOM	Starting to get more request for the mobile address. It is on a thread on the mobile page but it might help to have it more noticable on the splash page.
3.	1/20/2010	J73 USPACOM	Im thinking well create a series of short user guides and draft a blog post linking all resources together.
4.	1/24/2010	J73 USPACOM	I'd suggest we constrain the ratio proportions to a square or something. Its seems pretty wide for use on a mobile screen.
5.	1/29/2010	SOUTHCOM	Situation: 1. Within the Haiti HA/DR group, clicked on "BLOGS." 2. clicked on "news headlines." Results: 3. at the top center of the page, there is a small (8-10 POINT TYPE) "Haiti news and feeds" link. it's broken (404).

f. Emotional and Other

As with opinions, emotional support can be expected when humans interact especially when dealing with the stressful nature of an HA/DR event. As there were only two instances in which emotional support was the focus of the thought unit, it speaks to the professionalism of the APAN users. The following thought unit is an example of an emotional response: “Wow... this would be the true miracle story and if there is even 1 iota of a possibility that one is alive....” This could have been coded as an opinion, however, it was coded as emotion based on the verbiage used by the participant.

Other was assigned as a code 11 percent of the time (n=74). These are thought units that do not fit within one of the other categories regarding purpose of post. They are similar to the miscellaneous category defined under purpose of post and include non-task related material, provide acknowledgement or gratitude for some act, or are not related to the HA/DR events taking place.

E. INDIVIDUAL THREAD ANALYSIS AND NETWORK DIAGRAMS

Four threads were selected for in depth analysis and network diagramming. A synopsis of each thread is presented along with representative posts to provide an understanding of how APAN was used to collaborate during the Haiti HA/DR operation. A network diagram is included to aid in visualization of the information flow between the participating organizations and to provide a sense of how efficiently issues were dealt with and resolved. The network diagrams of the four threads each have a different configuration due to the different interactions that occurred between the participants.

1. Thread 7041—User Training Guide for Mobile and Deployed Users

Thread 7041, User Training Guide for Mobile and Deployed Users, was the most prolific thread in terms of the total number of posts per thread. A network diagram for thread 7041 is shown in Figure 9. This thread contained 33 posts and accounts for 2.4 percent of the total number of posts in the HA/DR forum. The discussion for this thread centers around the system related issues of making the APAN Web site easier to understand and more useable for mobile and deployed users by creating a series of

instruction manuals which, once complete, were posted on the APAN Web site. Mobile and deployed users are differentiated by the idea that deployed users refer to those individuals on the ground in Haiti while mobile users could be anywhere in the world where internet access is available. Both types of users rely on wireless networks for the transmission of information to their portable devices.

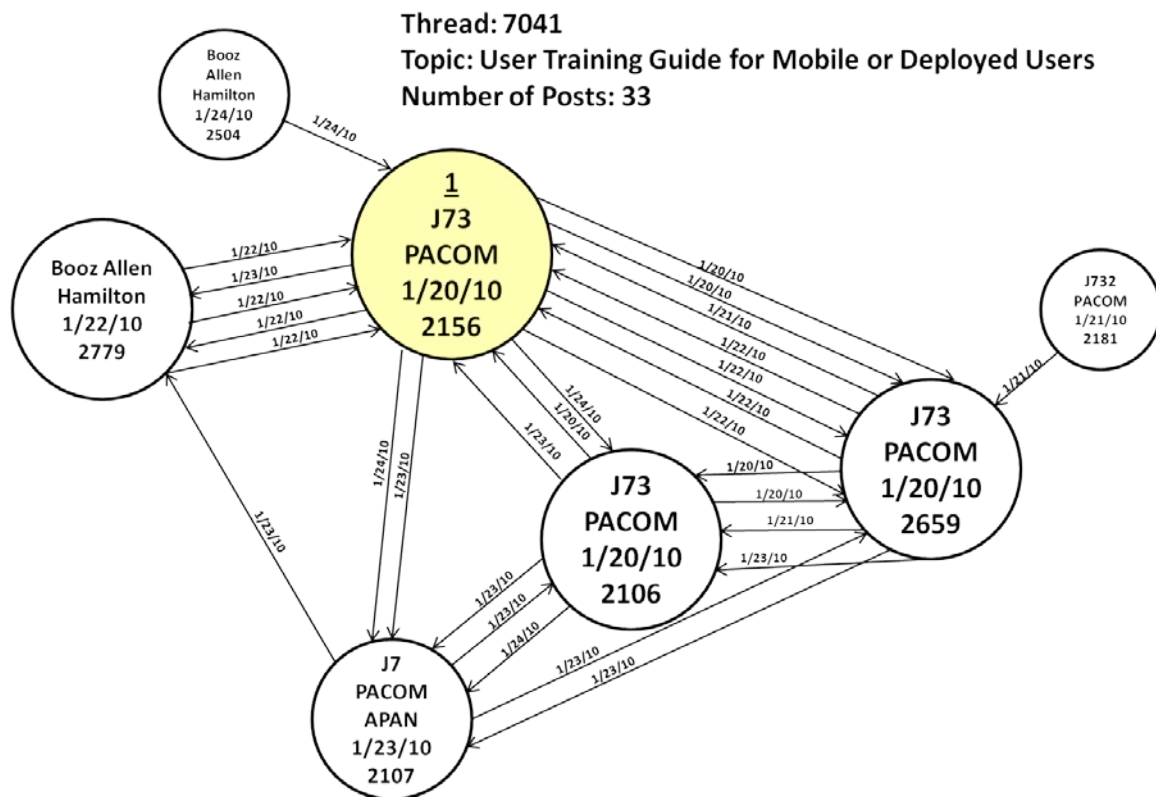


Figure 9. Network Diagram for Thread 7041: User Training Guides for Mobile and Deployed Users

After creating and testing the user guides, the team discovered that mobile users could not access the APAN HA/DR forums, regardless of platform or mobile device. Over a period of three days, members of the PACOM J73 team along with members of Booz Allen Hamilton were able to discover the cause of the inability of mobile users to access APAN and implement and test a solution for this issue.

As technical development of the APAN Web site resided with PACOM, the majority of the discussion was conducted by members of the PACOM J73 Simulation

Support Division. The network diagram shows a high level of interaction between a relatively small number of participants. One individual, the original poster, had the majority of interactions with a total of 18 of the 33 posts either initiated by him or in response to information he had posted. One of the benefits that the group of APAN users realized by using APAN was an increase in efficiency of task accomplishment—in this case, developing user guides for mobile and deployed users—as tasks could be accomplished by the parties most familiar with the problem and with the time available to implement solutions. That the group was able to confront the problems and collaborate to achieve solutions in such a short time was reflective of the hard work that went on behind the scenes to support APAN which allowed it to be used more effectively and efficiently by everyone involved in the Haiti response.

2. Thread 6677—Fuel Status

Concerned with the availability of fuel, especially for generators, shortly after the earthquake occurred, thread 6677 comprised 11 posts from six organizations and took place over three days. The network diagram for thread 6677 is presented in Figure 10. SOUTHCOM posted the opening query asking if anyone in the community had insight into the amount of fuel available especially to hospitals, gas stations, and police stations. Initial responses were repeated from news reporting, however, an individual associated with the National Defense University was able to provide a link to the most current situation report produced by the Office for the Coordination of Humanitarian Assistance (OCHA). As the community looked further into the original question, it was discovered that the primary Internet Service Provider (ISP) was low on fuel and required immediate resupply to continue operations. Multiple points of contact in Haiti were provided for the coordination of a fuel delivery however, there is no indication within the thread of how the situation concerning the ISP was resolved. The author infers that this was resolved off line via some other form of communication.

Thread: 6677
Topic: Fuel Status
Number of Posts: 11

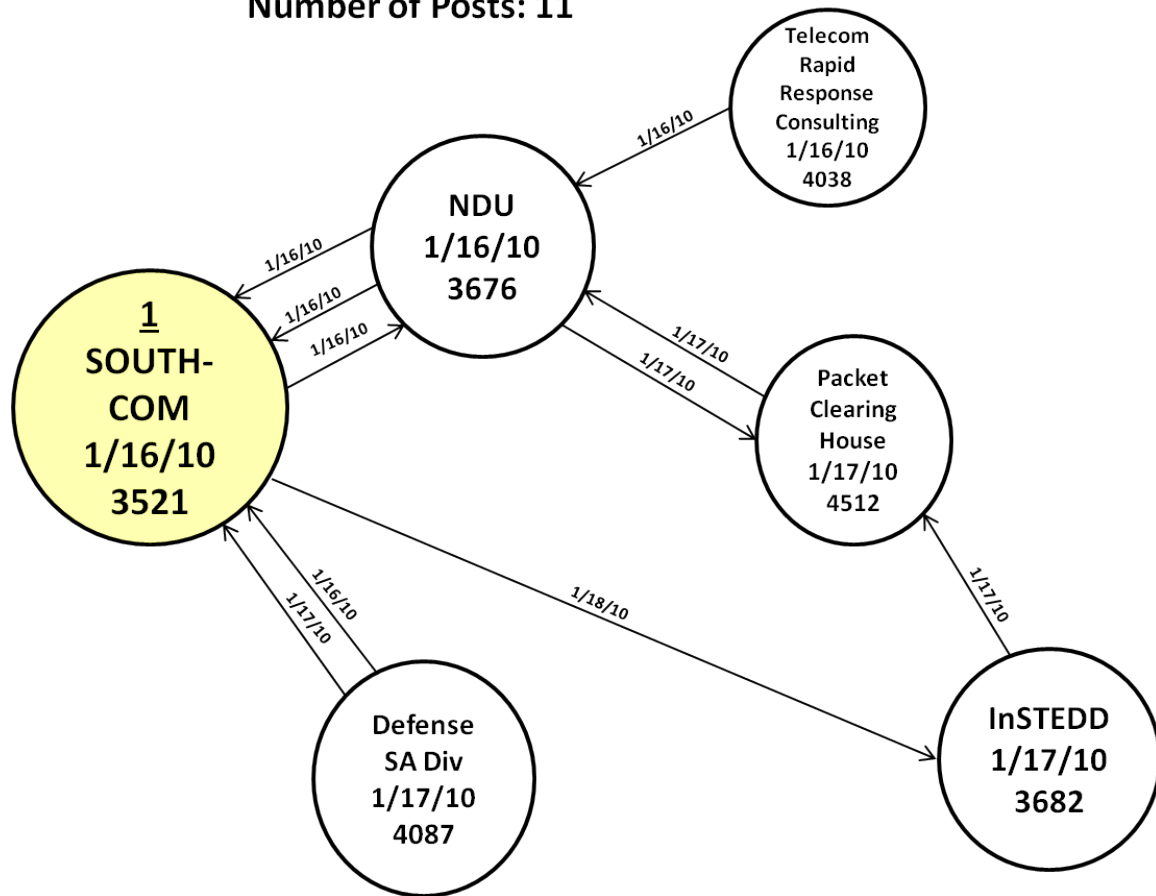


Figure 10. Network Diagram for Thread 6677: Fuel Status

The thread was fairly short lived and may have been so for several reasons. The first is that one of the posters created a parallel thread to deal with fuel issues. Another reason is that several of the posts specifically list e-mail addresses and phone numbers to allow coordination to take place outside of APAN. While this is not necessarily a negative development, it does preclude other users of APAN from reaping the benefit of continued situation updates and the ability to engage in the collaboration. Finally, the thread could have ended for other reasons including improved fuel supplies and

distribution within Haiti. Of interest, the final post of the thread lists several fuel related issues the individual is tracking but there are no follow-up posts. It is impossible to determine whether the individual received the further information he had requested.

3. Thread 6548—Current Imagery / Route Analysis

The ability to rapidly access information, process the meaning, and provide a response to participants in the field is one of the strengths of social media. A situation requiring such a response is evident in thread 6548—Current Imagery / Route Analysis. The network diagram for this thread is shown in Figure 11. A member from the 2nd Brigade Combat Team (2 BCT US Army) posted a request for information (RFI) for imagery concerning the status of local transportation routes in Port-au-Prince. Within several hours, there were six responses which either pointed to relevant imagery products or listed points of contact the 2 BCT could contact for more information. Some of the recommended POCs and imagery were created and maintained by the U.S. military however, others were non-military such as the UN logistics cluster as well as a route calculator being developed in Germany. A total of nine organizations responded to this RFI with nine posts. Within 24 hours, the SOUTHCOM RFI manager had logged on to determine if the previous posts had satisfied the RFI and 2 BCT responded that they had. This thread illustrates the efficiency and effectiveness that use of a collaboration site provides for enabling a diverse group of distributed participants – many of whom have not previously worked together – to bring their knowledge and expertise to bear to rapidly solve complex problems.

Thread: 6548

Topic: Current Imagery / Route Analysis

Number of Posts: 16

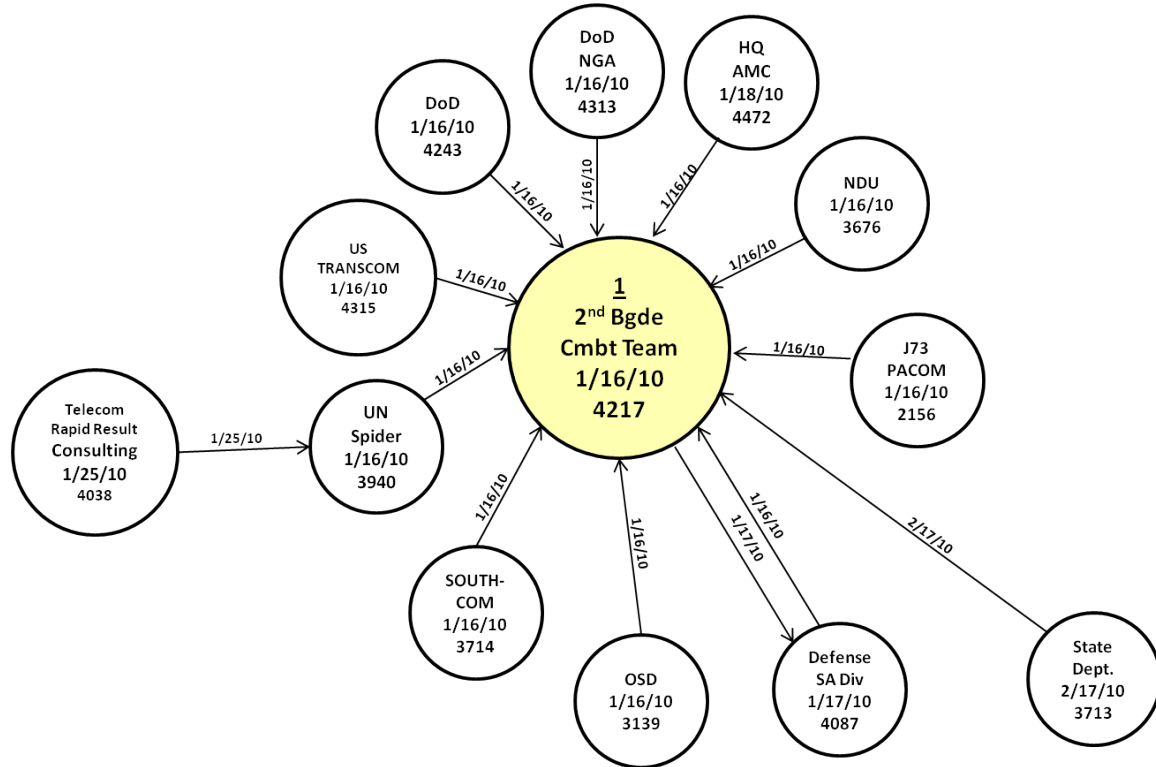


Figure 11. Network Diagram for Thread 6548: Current Imagery / Route Analysis

Thread 6548 exhibits a cluster formation with nearly all of the interaction flowing from respondents to the original poster and little interaction between the responding organizations. While many of the responses were from DoD entities, it should be noted that there were responses from other U.S. government agencies as well as a representative from the UN. Also, knowing that many users would be viewing the thread and attempting to view the imagery or maps, an individual from an NGO advised that most users would have to manually install a separate service to view some of the maps. Finally, it is worth noting that while the original poster had received an answer to his request within 24 hours, as further imagery became available, the thread continued to receive posts with the last one taking place February 17, 2010. As with all threads in the HA/DR forum, it remained active for others to see.

This thread exhibits several of the benefits that collaboration via social media can provide (see Table 1 Chapter I). The multitude of responses and range of information pushed by various users was more diverse than if the requestor had stayed within traditional military channels. The variety of products also indicated that multiple agencies were concerned with the problem which has the potential to improve the quality of the solutions. Finally, taking the link to the route calculator being developed in Germany as an example, the potential to discover novel, innovative solutions was enhanced. The full text of thread 6548 appears in Tables 19

Table 19. Text of Thread 6548: Current Imagery / Route Analysis

1/16/2010	4217		current imagery/route analysis " Is there an up-to-date site/point of contact who can direct me to a map PRODUCT DEPICTING THE STATUS OF THE ROUTES IN PAP? I AM LOOKING SPECIFICALLY for imagery with primary routes labeled and marked with their current degree of mobility. Any help would be much appreciated. RESPECTFULLY, cpt [name] Assistant S2 2ND BRIGADE COMBAT TEAM 82nd airborne division DSN: 432-xxxx "
1/16/2010	2156	J73 USPACOM	current imagery/route analysis " I know NGA is collecting this information. One of their analysts is COMPILING THESE INTO AN "ONLINE" PRODUCT WHICH IS STILL IN DEVELOPMENT BUT being built out in the mapping tools section on this apan site accessible from the menu. After clicking on the link to the Mapping Tools section be SURE TO SCROLL UP WHEN THE PAGE LOADS TO SEE THE BEGINNINGS OF THAT MAP. on the product as of right now, he lists routes 100,102, and 200 as operational 300 as unknown. I WOULD SUGGEST CONTACTING HIM DIRECTLY FOR MORE INFORMATION, POSSIBLY A ready product that he can provide you, or direct you to the right folks. his contact info is: MR. [name] 305-43x-xxxx "
1/16/2010	3139	DOD Office of the Secretary of Defense	current imagery/route analysis " Sir, INSTRUCTIONS FOR THE SIPR NET: -from nga website on sipr -upper right hand corner in the search box type: "GIBCO" -THEN VIEW PRODUCTS there they will find the products that the hati nst is producing Or, on the left hand side of the page go to hati. if this doesnt work, i will contact the marine nga nst

			and they will call in a team member to push the links to those that need them. just let me know. S/F msgt [name] MSgt NGA-HDNTB USA USMC [e-mail address] "
1/16/2010	3714	Country Insight SOUTHCOM	current imagery/route analysis " Might want to also look at the UN logistics cluster web site and the RELIEFWEB SITE. IT HAS A NUMBER OF MAPS. also take a look at the ithaca center from the eu they have some nice laydowns of the city and the damage. www.ithaca.polito.it/index.php [] WWW.RELIEFWEB.INT/.../JOPA-7ZRKUM [] "
1/16/2010	3940	technical consultant UN SPIDER	current imagery/route analysis " there are various products posted to www.disasterscharter.org , and a ton of stuff flying by of the crisismapper google group initiated by UN-OCHA. I will send you an invite if you send me a good email address. mine is [e-mail address] mobile +1-510-39x-xxxx BACK TO EXPLORING THIS SITE FOR THE GLOBALHAWK IMAGERY RUMORED TO BE somewhere on this site... Chris "
1/16/2010	3940	technical consultant UN SPIDER	current imagery/route analysis " Also, can we please have a POC to coordinate regarding GlobalHawk imagery or other unclassified sources we may share with the community? we are quite willing to rehost this imagery as ogc-compliant wms to get it out to the rest of the ecosystem for derivative map creation, PRECISELY like the INFRASTRUCTURE DAMAGE ASSESSMENT MAPS THAT INITIATED THIS THREAD. [name] UN-SPIDER "
1/16/2010	4087	Defense SA Div	current imagery/route analysis " CPT [name], SOUTHCOM RFI mgr here. do the 2 posted replies answer your rqmnt? please advise.

1/17/2010	4217		current imagery/route analysis "Yes, it does. Thank you.
1/18/2010	4472		current imagery/route analysis CPT [name] i have a powerpoint with route analysis but its on the highside. if you want u can email me in my niprnet and let me know if you have access to the sipr. [e-mail address]
1/25/2010	4038	Telecommunications Rapid Response Consulting	current imagery/route analysis " Just a comment on this post - In case some of you are trying to use this file, web map service wms standard, it is not automatic in most browsers that use xml.files. you may have to manually install the service. "
1-16-2010-11-07	4315	USTRANSCOM	current imagery/route analysis TRANSCOM and NGA are working on route studies for Route 1 between Cap HAITIEN AND PAP.
1-16-2010-11-27	4313	DOD NGA	current imagery/route analysis CPT [name]- there are a series of annotated image maps for PAP prduced by SOUTHCOM - some are on this site - do you have access to sipr? if so - email me you address at: [e-mail address]
1-16-2010-20-39	3676		current imagery/route analysis " OpenStreetMap (OSM) is assembling a frequently updated map of route blockages. see zvenzzon.mine.nu/map.html []. legend and layers can be opened via the menu (+ sign) on the right. Also see wiki.openstreetmap.org/.../WikiProject_Haiti []. an open route calculator is being developed here: openls.geog.uni-heidelberg.de/osm-haiti []. "

1-17-2010-4-07	4243		current imagery/route analysis " Sir, check this SIPR site. [name] ussouthcom s&i Mission Assurance AT/FP DSN 56x-xxxx instructions for the sipr net for current imagery/route analysis: -From NGA Website on SIPR -upper right hand corner in the search box type: "gibco" -then view products (there they will find the products that the Haiti NST is producing) or, on the left hand side of the page go to HAITI. if this doesn't work, i will contact the marine nga nst and they will call in a team member to push the links to those that need them. Just let me KNOW. s/f [name] NGA-HDNTB USA USMC [e-mail address] "
1-25-2010-16-23	3940	technical consultant UN SPIDER	current imagery/route analysis " We have the WorldBank 15cm imagery online now as WMS, along with the NOAA AND GOOGLE FLIGHTS; THE WMS ENDPOINT IS: maps.geography.uc.edu/.../mapserv [] This also has the entire country at 1m or better via the Digital Globe CRISIS EVENT SERVICE PROXY. you'll have to zoom into 1:5000 to see this new stuff. Chris [name]UN-SPIDER "
2-17-2010-5-33	3713	Humanitarian Information Unit US Dept of State	current imagery/route analysis " The UNOSAT imagery derived maps unosat.web.cern.ch/.../prod_free.asp [] should have visualization of the information you are requesting, as well AS the latest reporting coming out of the logistics cluster oneresponse.info/.../Logistics.aspx [name] humanitarian information unit US Department of State WASHINGTON DC "

4. Thread 8687—Future Planning and Information Management

After initial crisis response activities begin to transition to longer-term disaster relief activities, supporting organizations need to coordinate with each other to ensure information was shared and to maximize the use of limited resources. To aid in this process, on January 27, the U.S. State Department created Task Force 4 to conduct future planning for reconstruction and stabilization and to ensure continued information flow to agencies involved. The first post of thread 8687 notified the community regarding the creation of Task Force 4 and listed the four working groups involved. The person posting also queried the community to find points of contact at HACC, JTF-Haiti, and SOUTHCOM so they would be aware of the situation.

Most of the respondents were associated with the U.S. Government and detailed the personnel responsible for future planning in their organization as well as brokering information for other groups concerned with the reconstruction of Haiti. There was also a representative from the UN among those responding to the initial post. The post by the UN member received several more responses from other NGOs including the Global Institute for Disruptive Events (GIDE), Telecom Rapid Response Consulting, and NGO Internews. All were appreciative of the dialogue taking place in APAN with one asking for POCs in Haiti, one offering a link to their information service, and the last commending the developers of the APAN site and offering suggestions on how to make more effective use of the forums and blog section. The network representing the flow of information for the Future Planning and Information Management thread is diagrammed in Figure 12.

Thread: 8687

Topic: Future Planning and Information Management

Number of Posts: 19

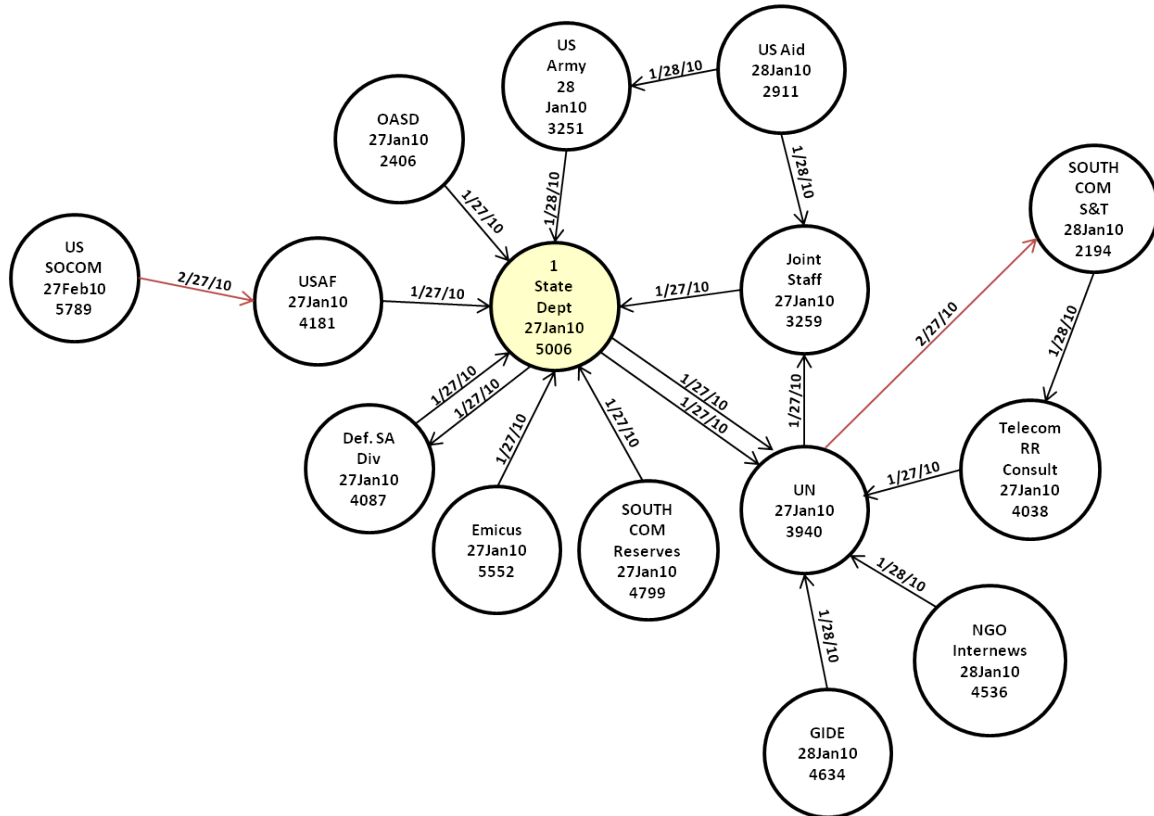


Figure 12. Network Diagram for Thread 8687: Future Planning and Information Management

By the time the last post had been added to the thread, 15 organizations had participated in the discussion with many of those offering links to further information or POCs within their organizations to be a part of the future planning cells. The majority of posts took place on 27 or 28 January, indicating how fast information can flow using social media. There were two late entries which took place on 27 February (indicated by red lines in the network diagram), which shows that individuals were still reading the thread, even after the primary discussion had taken place. They did not receive responses within the forum, so it is impossible to tell if they received the information they requested.

Finally, several comments provided positive feedback on APAN as a means of communication and information sharing. After receiving several responses to the initial post, the user stated, “Thanks everyone for your responses! APAN will definitely be a part our information flow.” Another stated, “I am glad you guys are using APAN. I find it very useful. Key is, we need to get more watchstanders in the interagency plugged into to it.” These responses indicate a key benefit to collaboration was being realized: Relations between stakeholders improved, building capacity, networks, and relations. Other benefits were also realized, as the essential purpose of the post was to establish mechanisms for coordinating future actions and diverse responses were anticipated.

F. INTER-RATER RELIABILITY

Inter-rater reliability is the measure of agreement between two or more raters when applying a coding scheme to a body of data. Coding in this research required applying multiple definitions within the coding scheme for purpose of post and type of post categories. To determine if the definitions for the codes were applied consistently the agreement between the raters was calculated. A second coder coded a subset of the overall data. Table 20 presents the number of codes assigned to each category for the purpose of post. The first rater’s coding results are displayed in the columns and the second rater’s results are displayed in the rows. The intersection for each category is highlighted and displays the total times the raters agreed on a code assignment. The remaining numbers indicate the times a rater applied a code that differed from the other rater. The values indicated for each rater (highlighted in grey) depict the total number of times that particular rater assigned the code within the category. For example, looking first at the Query / RFI category, rater A assigned the query / RFI code to 45 thought units as opposed to rater B who assigned the query / RFI code to 37 thought units. The raters agreed on the assignment 37 times and disagreed eight times.

Table 20. Rater Results Matrix for Purpose of Post

Purpose of Post Coding Results						
Categories	Query/ RFI	Response	Info Push	Info Broker	Misc	Total Rater B
Query/RFI	37	0	0	0	0	37
Response to Query	2	37	10	0	1	50
Info Push	6	10	120	2	2	140
Info Broker	0	1	2	8	0	11
Misc	0	1	2	0	25	28
Total Rater A	45	49	134	10	28	266

The Probability of Agreement, Pr (a), for purpose was calculated using the following formula: $Pr(a) = (37+37+120+8+25) / (266) = 85.3$ percent. The Probability of Chance Agreement Pr(e) was calculated with the following values: $Pr(e) = (45 * 37) + (49 * 50) + (134 * 140) + (10 * 11) + (28 * 28) / 266 = 33.5$ percent.

Using the formula in the Methodology Chapter results in a Cohen's kappa coefficient of 77.8 percent indicating rater A and rater B had a substantial amount of agreement when coding for purpose of post.

Table 21 depicts the results matrix for codes assigned within the type of post.

Table 21. Rater Results Matrix for Type of Post

Type of Post Coding Results								
Categories	Opinion	Situation Update	HA/DR General Input	Action Related	System Related	Emotional	Other	Total Rater B
Opinion	0	0	0	0	0	0	0	0
Situation Update	0	9	0	1	0	0	0	10
HA/DR General Input	3	2	97	3	15	0	4	124
Action Related	0	0	1	12	0	0	0	13
System Related	0	3	7	0	80	0	1	91
Emotional	0	0	0	0	0	0	0	0
Other	0	1	2	0	0	0	25	28
Total Rater A	3	15	107	16	95	0	30	266

The Probability of Agreement, $Pr(a)$, for type was calculated using the following formula: $Pr(a) = (0+9+97+12+80+0+25) / (266) = 83.8$ percent. The Probability of Chance Agreement $Pr(e)$ was calculated with the following values: $Pr(e) = ((3 * 0) + (15 * 10) + (107 * 124) + (16 * 13) + (95 * 91) + (0 * 0) + (30 * 28)) / 266 \text{ squared} = 32.6$ percent.

Using the formula from the Methodology Chapter the result is a Cohen's kappa coefficient of 75.9 percent indicating rater A and rater B had a substantial amount of agreement when coding for type of post.

V. CONCLUSIONS AND RECOMMENDATIONS

A. BENEFITS OF THE RESEARCH

This thesis investigated the use of one social media site—All Partners Access Network—during its debut as a platform for collaboration during an HA/DR event in the SOUTHCOM AOR. Two coding categories were created to understand how APAN was utilized to share information: (1) Purpose of post and (2) Type of post. A portion of the data was coded by two raters and inter-rater reliability was calculated. They had a ‘substantial’ degree of inter-rater agreement in code assignments which indicated the definitions for the codes were applied consistently. The majority of the posts in the Haiti HA/DR forum that were coded for purpose involved pushing information to the community (see Table 8). Other purposes, such as posting queries, responding to queries, and brokering, were observed as well. Acquiring, storing, and sharing information are the primary reasons to utilize a social media site and the results indicate APAN fulfilled these knowledge management requirements.

The majority of the posts coded for type of post were coded as HA/DR general input, however, there were sizable percentages of other category types such as situation reports, system related, and action related posts as well. After analyzing and coding the posts in APAN, it is inferred that many of the posts improved the overall situational awareness of the Haiti responder community although it was not possible to measure this. System related posts were expected as APAN was being utilized for the first time in the SOUTHCOM AOR. As participants utilized APAN, they became aware of potential areas for improvement and made requests for either user guides or additional system functionality. Finally, as APAN was used by personnel who had prior experience in responding to HA/DR events, there were notably less posts coded for opinion or emotion than might be seen on a social media site primarily used by civilians (as noted by Qu et al., 2011).

Collaborating via APAN allowed participants to reap many of the benefits of collaboration as listed in Table 1 (in Chapter II): (1) A broad analysis of the various

problems improved the quality of the solutions. For example, this was particularly evident in thread 7041: User Training Guide for Mobile and Deployed Users. (2) The response capability was diversified and (3) collective action involving dispersed participants was enhanced. These benefits were evident in many of the threads including thread 6677: Fuel Status and thread 6548: Current Imagery / Route Analysis. (4) Parties familiar with problems created solutions. This benefit could be seen in Thread 7041: User Training Guide for Mobile and Deployed Users. (5) The potential to achieve novel and innovative solutions was enhanced. This benefit is exemplified by the following quote from thread 6705: Increase Speed of Supplies to Distro Points:

If [slings are] not available - try also jumbo bags/super sacks/ib bags. Should be available in DR - used in sugar/commodity trade - check with commercial port/shipping community. Limits are capacity - usually 1mt or less. Reusable, but low cost abt us\$30 in USA makes it disposable. Rig with a shackle for quick/snag free disconnect from rw hook. Same bags filled with sand used for rapid levee repair by rw in Katrina.

(6) Relations between the stakeholders improved and (7) mechanisms for coordinating future actions were established. These benefits could be seen in Thread 8687: Future Planning and Information Management.

At the same time, using social media avoided or surmounted several obstacles to collaboration that have been reported on in the research literature: (1) Despite claims that collaboration is a slow process, in many cases participants were able to collaborate quickly to provide solutions. (2) No evidence exists to indicate that some participants wielded more power than others, thereby unduly influencing potential solutions. The peer-to-peer nature of APAN has been cultivated to facilitate information sharing between individuals and organizations that may not have worked well together in the past. (3) The idea that collaboration works better in small groups was countered as APAN enabled a large community of responders to share information which improved potential solutions.

Participants using APAN were able to share information and collaborate across institutional boundaries that would have been difficult to breach prior to its inception. By

February 2, 2010, the UN Office for Coordination of Humanitarian Affairs estimated there were at least 400 non-governmental aid agencies operating in Haiti (USAID Factsheet #26). Seventy-nine (20%) of those made at least one post in the HA/DR forum and others may have participated on APAN in other forums, wikis, or blogs. This seems encouraging given that this was the first time APAN was used in the SOUTHCOM AOR. There is no evidence to suggest that organizations did not participate in APAN due to historical or ideological barriers as referenced in Table 2, “Obstacles to Collaboration.”

This author was unable to determine if societal dynamics prevented groups with different cultural backgrounds from collaborating via APAN. As noted in Chapter I, by February 2, 2010, 102 countries had responded with financial or materiel aid, yet, by June 3, 2010, organizations from only three foreign countries (The Government of Canada, The Royal Navy of the Netherlands, and the Spanish Army) had posted on the Haiti HA/DR forum. There are two possible explanations for this. The relatively small amount of posts by foreign countries may be explained by a lack of awareness that APAN was available for use, that is, other collaboration sites were used during the Haiti HA/DR operation. Secondly, in many cases countries that sent financial or materiel aid did not need to participate at the level entailed with APAN as they may have contributed via the UN or other international agency and they may not have participated in the day-to-day collaborative effort. Finally, as APAN utilizes the English language, the format may not have been conducive for communicating with non-English speakers.

Determining if participants were unwilling or unable to share, help, or find the information they required is not possible to ascertain from the type of investigation conducted for this research. A study involving surveys of individuals from organizations participating in the Haiti relief effort but not participating via APAN would need to be conducted to determine the reasons for not utilizing the APAN Web site.

B. SOCIAL MEDIA AND APAN

Thread 7041: User Training Guides for Mobile and Deployed Users, contains examples of several of the benefits of collaboration listed in Table 1. (Note, the numbers in parentheses in this section indicate the specific benefit listed in Table 1.) The seven

people involved in this thread *provided a broad, comprehensive analysis of the problem domain that improved the quality of solutions* (1) created for developing the user training guides. Initially, the PACOM developers of APAN were unsure regarding whether a technical solution or a procedural solution was needed to provide the capability to send emails to all members of the Haiti HA/DR community. Because APAN had not been previously used for such a large-scale effort in the SOUTHCOM AOR, the developers were still learning about some capabilities such as whether all members received e-mail notifications when a post is created in the forum. The various posters to thread 7041 immediately began brainstorming about the ways this could be implemented and ways to achieve the desired results.

Due to the criticality of having the functional capability of keeping all members of the responder community up to date on every posting, all posters to this thread provided *a focused and diversified response* (3). This diversified response involved all the posters brainstorming about ways to provide the needed functionality and offering solutions. PACOM, as the original developer of APAN was keenly interested in ensuring that all users of the APAN HA/DR community could receive e-mail notifications when a post was created in the forum—and they *retained ownership of the solution* (8). Moreover, since several members from PACOM were actively involved in the discussion thread, *parties most familiar with the problem invented the solution* (9). This participation and development of the solution by PACOM *enhanced acceptance of the solution* (10) and willingness to implement it. Additionally, *the potential to discover novel, innovative solutions was enhanced through the cross-pollination of ideas* (11). Within three days of uncovering the need for all members of the responder community to have the capability to receive e-mail notifications when a post was created in the forum various approaches to providing this capability had been considered and tested, and a workable solution was produced with an updated user's guide posted for all APAN users.

When a study of a social media is conducted and the results indicate that the collaboration was efficient and effective, one might ask if the same results could have been achieved by other means. In this case, could collaboration have taken place in a face-to-face manner, via e-mail, or by telephone, to achieve the same results? Though

collaboration undoubtedly took place via other means, APAN provided the knowledge management and information sharing medium that participants could use to connect with each other. Phone numbers, e-mail addresses, internet links, wikis, and blogs were all shared via APAN. Collaboration on the scale of the Haiti HA/DR response, among such a geographically dispersed and diverse community of responders could not have been achieved via other means.

Face-to-face collaboration is physically impossible with the size and dispersal of the Haiti HA/DR responder community. E-mail has been cited as a poor collaboration tool, for example, the Columbia Accident Investigation Board (2003) findings state: of the eight missed opportunities that might have avoided the Columbia space shuttle tragedy, at least six were related to over-reliance on the use of email. The Board further found that e-mail tended to remain within local channels and often e-mail was not followed-up in a timely manner. Finally, like face-to-face or e-mail interaction, collaboration via telephone is possible in a limited sense, however, collaboration via telephone requires each member of the community to have access to a telephone, and maintain an accurate list of phone numbers for all other members. The main drawback to telephone use is the limited number of people who can participate in any teleconference.

Along with the successes of APAN, one must consider any factors that could be improved upon. The percentage of posts categorized as information push was expected because in such a novel situation a large amount of information needed to be shared and assimilated by all respondents. This results in a large percentage of single posts.

C. USER INTERFACE RECOMMENDATIONS FOR APAN

Several user-system interface recommendations are offered with an eye toward providing additional functionality to APAN, while maintaining the basic design premise of simplicity and ease of use. One suggestion for improving APAN functionality involves incorporating a question-answering (QA) tool. A QA tool is a form of information retrieval where the user's information need is specified in the form of a natural language question, and the desired result is a self-contained answer (not a list of documents or links to further reading). Including a QA is particularly applicable to social

media, as it provides a potentially more effective alternative to web search by directly connecting users with information needs to users willing to share the information (Bian et al., 2008).

Another suggestion that capitalizes on technology developments would be to implement the use of a software tool called an intelligent agent or “informant.” An informant allows a member of the community to enter a list of key words which will be searched at periodic time intervals. If one or more of the words were used in a forum, wiki, or blog, an e-mail would automatically be generated to inform the requesting user that new information is available. An informant can also be used to check for updates to a particular site at pre-determined intervals. If the site is updated or new content added, an e-mail will be sent to the user.

APAN is a community based social media Web site and as such, subject to monitoring by the members of the community. There are various levels of users of APAN which include members, managers and owners of different groups, one of which was the Haiti HA/DR group. SOUTHCAM has noted that group owners, vice the APAN support team, are responsible for the layout and presentation of their group site: some group sites may be easier to navigate or more user friendly than others. To ensure that a group site is easily navigable and presents relevant information in a user friendly manner, frequent group owner training is necessary.

The final recommendation involves the APAN user-interface. Qu et al. (2011, p. 3) note that on a highly active social media site, hundreds of posts could be created every minute causing critical information to “sink” or “fade away”. A critical task of an HA/DR effort is to respond as quickly as possible to specific problems that have been identified by relief workers. To facilitate sharing critical information, specifically about problems needing immediate attention, and to reduce response times, Hutchins (2011) recommends that information concerning an urgent need could be copied and pasted to a separate window, or portlet, to increase the situational awareness of other relief workers regarding urgent tasks. This window could be labeled ‘Anticipated/Urgent Problems’ and could include a column on the right-hand side for a user to place a check-mark to

indicate when the task had been completed. To ensure that this window does not become abused through over-use, continuous management oversight by a qualified moderator may be required. Alternatively, an automatic filtering mechanism might be used to identify posts requiring immediate action, and highlight or move them to a specified window on the home page to increase their visibility within the community.

D. RECOMMENDATIONS FOR FURTHER STUDY

When this research was originally conceived, the primary focus was anticipated to be analyzing the collaborative communications and coding for the benefits of collaboration to describe how APAN was used as a collaborative environment. While there is evidence that many of the benefits of collaboration were achieved, the benefits of collaboration are difficult to measure from communication data alone. To investigate further, a study in which participants are asked to fill out a survey regarding their experiences would provide data to directly measure the benefits of collaboration especially those that are not easy to detect from content analysis of posts in the collaboration system.

As this research was primarily concerned with the interactions of the members, further study may be conducted to understand how the different levels of users interact. Of specific interest would be to study the role of the managers and how they ensure queries and RFIs are answered in a timely manner. Research could investigate aspects of managing a group and the emergence of ‘power users’ or those members of the community that actively monitor the group for queries or critical information requests.

Research that involves analyzing the differences in HA/DR response between responders in a developing country such as Haiti, and responders in a developed country such as Japan, could provide insight into how information is shared under different circumstances.

Finally, Bui & Sankaran (2006) advocate the development of a global information network (GIN) or a global emergency response system (ERS). They believe that such a system should enable the flow of information and team collaboration as well as integrate expert knowledge through globally dispersed knowledge bases. Currently, APAN is a

DoD tool rather than an HA/DR Web site in general; research could be conducted to determine if APAN provides a model of what a global system might look like. Alternatively, research could be conducted to see how many requirements of the GIN or ERS are currently provided by APAN and if it is capable of fulfilling the role of a global system.

APPENDIX A. TIMELINE OF EVENTS

- **12 January 2010**
 - A 7.0 magnitude earthquake strikes Haiti. The epicenter was located at near the city of Léogâne and struck at 1653 local time.
- **13 January 2010**
 - APAN Web site Haiti HA/DR community established
 - First elements of Department of Defense (DoD) humanitarian assistance arrive in Haiti at dawn.
 - 1st Special Operations Wing arrives in Haiti and reopens the Toussaint Louverture International Airport. U.S. military aircraft immediately begin to deliver relief supplies.
 - Coast Guard cutter Higgins arrives to start evacuating American citizens.
 - A 17 person USAID Disaster Assistance Response Team (DART) arrives in Haiti to assess humanitarian needs and to coordinate relief efforts with the Haitian government.
 - Search and rescue teams from local U.S. communities including Fairfax County, VA, and Los Angeles County, CA, arrive in Port-au-Prince to look for survivors.
 - U.S. Ambassador to Haiti, Kenneth H. Merten, declares a state of emergency in Haiti allowing funds to be utilized to provide immediate assistance.
- **14 January 2010**
 - U.S. SOUTHCOM establishes Joint Task Force – Haiti and designates it as the lead command and control organization for the DoD’s relief efforts.
- **15 January 2010**
 - United States aircraft carrier USS Carl Vinson arrives off the coast of Haiti to assist in relief efforts.

- U.S. government announces a special immigration status for Haitians living in the U.S. which protects them from deportation for 18 months.
- Russian search and rescue teams cease all activity at night due to looting and other insecurity in the area.
- The undamaged Jacmel airport becomes primary airport.
- **16 January 2010**
 - Haitian President René Préval meets with Secretary of State Hillary Clinton and USAID Administrator Raj Shah along with other U.S. government officials in Haiti to discuss relief operations.
 - U.S. Dept of Defense creates Joint Task Force Haiti to coordinate Pentagon relief efforts.
- **17 January 2010**
 - The first of 14 Red Cross Red Crescent Emergency Response Units (ERUs) arrive and begin providing basic health care.
- **19 January 2010**
 - U.S. SOUTHCOM establishes Joint Logistics Command Haiti to coordinate the movement of supplies to Haiti.
 - USS Bataan Amphibious Ready Group (ARG) arrives off the coast of Haiti. The ARG includes the 22nd Marine Expeditionary Unit (MEU) and facilities to provide relief supplies and medical care.
 - A Canadian team finishes the installation of lights on the runway at the Jacmel Airport in Haiti. This allows for 24 hour flight operations and relieves congestion at the Toussaint Louverture International Airport.
- **20 January 2010**
 - The hospital ship USNS Comfort arrives off the coast of Haiti to provide medical assistance.

- A 5.9 magnitude aftershock strikes Haiti. This is the largest aftershock since the earthquake.
- **22 January 2010**
 - Total U.S. personnel in the Haiti Joint Operational Area grows to 13,657 personnel with 3,258 personnel ashore and 10,399 afloat.
 - Government of Haiti announces new adoption procedures to protect children leaving the country. These new procedures were intended to prevent the abuse of children and human trafficking.
 - Canadian Air Force activate air traffic control over Jacmel airport facilitating 24 hour a day flight operations.
- **23 January 2010**
 - Haitian government ends its formal search for survivors.
- **25 January 2010**
 - 24th MEU begins to distribute relief supplies to areas around the northwest portion of the capital.
- **28 January 2010**
 - Food distribution continues to be a problem. UN personnel are forced to use rubber bullets and tear gas to disperse mobs at several food distribution centers.
- **5 February 2010**
 - U.S. government's efforts in Haiti officially transition from Phase I (Emergency) to Phase II (Relief) operations.
- **8 February 2010**
 - Evans Monsignac is rescued from a collapsed building after spending 27 days trapped in the rubble.
- **10 March 2010**
 - USNS Comfort completes mission and departs for homeport.
- **16 March 2010**
 - World Bank estimates that \$11.5 billion are required over at least 3 years to reconstruct Haiti.

- **31 March 2010**
 - International Donors Conference: Towards a New Future for Haiti was held in New York City at the United Nations Headquarters. The conference raised funds from numerous organizations to help fund the Haiti recovery efforts.
- **21 April 2010**
 - Haitian President René Préval announces the creation of the Interim Commission for the Reconstruction of Haiti (IHRC) to help coordinate and prioritize long-term recovery efforts.
- **1 June 2010**
 - U.S. military announces the end of major relief operations in Haiti. A 500 man force of U.S. National Guard Troops remain in Haiti until September to provide additional support.

APPENDIX B. ORGANIZATIONS PARTICIPATING IN THE HAITI HA/DR COMMUNITY OF THE APAN WEB SITE

U.S. Military	International	U.S. Government	Non-Profit	Commercial
Department of Defense	Medical Relief International	Department of State	American Public Transportation Foundation APTF	AAR Global Solutions
Africa Command USAFRICOM	National Defense Govn't of Canada	Federal Emergency Management Agency FEMA	Delta State University	ASI Group
U.S. Air Force USAF	Navy, Netherlands	Department of Homeland Security DHS	Field Director Caribbean Missions	Barbary Consulting Services
U.S. Army USA	NATO North Atlantic Treaty Organization	Health Services, CA	Field Operations Baptist Haiti Mission Fermathe Haiti	Booz Allen Hamilton
U.S. Marine Corps	Spanish Joint Ops Command Spanish Armed Forces	Agency for International Development USAID	Haiti Missionaries of Charity	Cisco Tactical Operations, Cisco Systems Inc
National Defense, CA	United Nations UN		Hands On Disaster Recovery	Construction Management Arcotec SA
National Defense University NDU	World Health Organization WHO		Health4haiti	Construction Make it Right
Northern Command USNORTHCOM			Hillside Church	CE2 Engineers, Inc
Naval Postgraduate School NPS			Hollywood CERT Community Emergency Response Team	Ceres Environmental Services
Space Systems Support Group SSSG			InSTEDD	Copernicus Energy Inc
Pacific Command			Lamp for Haiti	Cotecna, Inc

USPACOM			Foundation	
Southern Command USSOUTHCOM			IRIN	CTO SkyVision Global Networks, UK
U.S. National Guard			Oasis for Children	Development The Millennium Group Intl
US Coast Guard USCG			Packet Clearing House	DF Risk Evaluation
Transportation Commmand USTRANSCOM			Partners in Health	DigitalGlobe Inc
			Pax Mondial	DRS Technologies
			Project K.I.D., Inc	Digital Technology International DTI
			Sahana Software Foundation	Eagle Motors LLC
			Santiago Un Techo para mi Pas, CL	Editorial Southern Pulse
			Shale Rock Farm Inc	Emicus com
			Team Rubicon, Inc	ERDAS, Inc
			The Scarlet Project	Ericsson Federal, Inc.
			Tohoku University	Evergreen International Airlines
			University of Georgia	Federal Wave
			University of Hawaii	FortiusOne
			University of Miami	The MITRE Corporation
			William J Clinton Foundation	Geospatial Open Solutions Group

			World Cares	GIS Thermopylae Sciences and Technology
				Global Health Initiatives Inc
				GIDE Global Institute For Disruptive Events
				HALEF Haitian American Law Enforcement
				ICT Packet Clearing House
				International Cooperation Team Good Neighbors International, KP
				Internews Network
				International Medical Corps IMC
				Kinston Global Partners LLC
				ManTech International Corporation
				North Shore Journal
				Palantir Technologie
				Rapid Response Consulting

				Risk Management International Mission Board
				SAIC
				SatProf, Inc.
				Strategos
				SUNRNR of Virginia
				Telecommun ications Rapid Response Consulting
				Telligent Enterprises,
				T.Y. Lin International
				Task Force, Inc.
				URS Corp
				Wireless Emergency Response Team

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